DOCTORAL PROGRAM IN AQUACULTURE/FISHERIES

University of Arkansas at Pine Bluff™

Proposal

April, 2011

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1. Proposed Program Title:
Doctor of Philosophy (Ph.D.) in Aquaculture/Fisheries

2. CIP Code Requested: **01.0303**

3. Contact Person:

Dr. Carole Engle
Director/Chair
Aquaculture/Fisheries
University of Arkansas at Pine Bluff
1200 N. University Drive
Pine Bluff, AR 71601
TEL: 870-575-8523
FAX: 870-575-4637
E-mail: cengle@uaex.edu

4. Proposed Starting Date:
Fall 2011

5. Program Summary

The Department of Aquaculture and Fisheries has an established undergraduate program in Fisheries Biology and an M.S. program in Aquaculture/Fisheries. Aquaculture is the cultivation of aquatic organisms under controlled conditions whereas the field of natural fisheries entails the study of fisheries populations in the wild. Aquaculture and fisheries comprise opposite ends of a continuum of management of aquatic environments that represents varying levels of control over the system. Aquaculture scientists develop scientifically sound methods for the culture and farming of aquatic organisms, and fisheries scientists develop scientific information to manage and conserve natural populations of fish. This document is a proposal to add a Doctor of Philosophy degree in Aquaculture/Fisheries to our existing programs to strengthen the aquaculture and fisheries sector in Arkansas.

This Ph.D. program is rooted in UAPB's expanded mission statement that discusses UAPB's evolving role in the state to develop innovative activities and use technology to help solve problems. While UAPB serves Arkansas and the nation, it has a particular emphasis on the Arkansas Delta and is committed to programs that reflect the needs of the state and region. The Center is considered a strength of UAPB; the UAPB Vision Statement published by the Arkansas Department of Higher Education, states that "We believe it is important to the future of the University of Arkansas at Pine Bluff (UAPB) that UAPB be known for its Center of Excellence – Aquaculture/Fisheries,…."

UAPB has the only Aquaculture/Fisheries Center of Excellence in the state. The University of Arkansas Board of Trustees created Centers of Excellence in areas critical to the state's economic growth and development in 1988. The UAPB Aquaculture/Fisheries Center of Excellence, along with the Poultry Science Center of Excellence at the University of Arkansas at

Fayetteville, were some of the first created. The Aquaculture/Fisheries Center has become a nationally and internationally-renowned source of research-based information in the areas of aquaculture and fisheries. The UAPB Aquaculture/Fisheries Center is charged with providing the teaching, research, and extension support to the aquaculture industry and to fisheries managers in the state. Academic programs in aquaculture/fisheries extend theory into practical applications and solutions to problems faced by stakeholders in the state and across the country.

The process of research is fundamentally a process of solving problems. Just as Ph.D. programs in engineering and agriculture train Ph.D. scientists to solve problems through applied science methods, Ph.D. students in aquaculture/fisheries will solve problems of aquaculture and fisheries stakeholders through applied and strategic research. Such a stakeholder-driven basis for developing research and extension programs is fundamental to the mission of land-grant universities. In Arkansas, there are two land-grant universities, the University of Arkansas at Fayetteville and the University of Arkansas at Pine Bluff. The USDA requires that NIFA funding and the state funds required as match be spent on projects developed through a defined stakeholder-input process. USDA defines stakeholders as those who use agricultural research, extension, and education programs. Stakeholders identified for the Aquaculture/Fisheries Center are the state's aquaculture industry and fisheries resource managers (See Appendix A for the Mission Statement of the Aquaculture/Fisheries Center).

Arkansas plays a unique role in aquaculture/fisheries in the United States. It is the birthplace of warmwater aquaculture in the country, is the second-leading aquaculture-producing state, and is home to many national leaders in aquaculture/fisheries. Aquaculture and fisheries have had significant impacts on the rural economies of the Delta, through the multiplier effects of expenditures in local communities by aquaculture businesses, and through expenditures by anglers who enjoy the excellent recreational fishing opportunities in the Natural State. Advancements in aquaculture production technologies and in understanding and managing the natural fisheries resources of the state have driven the growth and competitiveness of these sectors.

Arkansas is the second-leading aquaculture producing state in the U.S. Arkansas leads the nation in production of bait minnows, Chinese carps, hybrid striped bass fry and fingerlings, largemouth bass foodfish, and is third in catfish production. There are 4th generation fish farmers in Arkansas that include several national industry leaders. Much of the economic activity generated by aquaculture is in the Delta region that is characterized by high rates of poverty and unemployment. The recreational fishing industry creates expenditures of $425 million per year in Arkansas, powered by the 655,000 anglers who fish in Arkansas each year (U.S. Department of the Interior 2007). Appropriate science-based management of these resources will enhance benefits of the citizens of the state through direct access to the recreational benefits offered and also through the revenue generated through tourism.

The total impact of the UAPB Aquaculture/Fisheries Center has not been measured quantitatively. However, several components of its programs have. A 2002 IMPLAN-based analysis (using data from a survey of the catfish industry in that county) of the economic impact of the catfish industry on Chicot County, Arkansas, demonstrated that the catfish industry in that county alone generated $384 million in total economic output and 2,665 jobs in addition to $22 million in tax revenue. Moreover, catfish farming resulted in substantial development and expansion of support businesses that created additional jobs, economic activity and tax revenue. This impact analysis was extended to measure the economic impact of one particular UAPB-AFC extension program, Catfish Yield Verification. The adoption of the new farming techniques extended to catfish farmers through the Catfish Yield Verification program resulted in a reduction in the cost of production by 22%. The resulting total economic benefit was $67 million. A related study examined efficiency factors on catfish farms in Chicot County, Arkansas. This study determined that the AFC extension services in Chicot County generated about $3.5 million in cost savings among catfish farms, or about $1,896 per contact with AFC extension specialist.

The proposed program of study will lead to the Doctor of Philosophy Degree (Ph.D.) in Aquaculture/Fisheries. A student graduating from UAPB with a Ph.D. degree in Aquaculture/Fisheries will be trained comprehensively in the theory and practical application of aquaculture and fisheries sciences. The degree will be awarded in recognition of scholarly achievement that includes successful completion of courses of advanced study, satisfactory completion of preliminary examinations, and defense of a dissertation. The dissertation must address a significant need in aquaculture/fisheries. The program of study requires satisfactory mastery of both subject matter areas as well as the ability to design, implement, analyze, and publish results of research designed to solve stakeholder-identified needs.

Graduates of the UAPB Ph.D. program in Aquaculture/Fisheries will be expected to compete successfully for positions on the faculty of universities with aquaculture and fisheries programs, federal agency positions in research, extension, or policy arenas, in international agencies, and in the private sector. UAPB graduates will be expected to demonstrate the ability to design and carry out productive research and extension programs, have superior communications skills, both verbal and written, and to have superior teaching skills adaptable to both formal classroom and extension-related adult education. UAPB graduates will be expected to be skilled in the application of the latest research and educational technologies and techniques.

Anticipated new enrollment for each year is projected to be: Fall 2011, five students admitted; 2012 three students; 2013, two students; 2014, two students; and two new students in 2015. Five new students are projected to be admitted each year beginning Fall 2016 for a maximum program capacity of twenty Ph.D. students. This enrollment pattern is expected to generate the critical mass of Ph.D. students to form the community necessary to support a dynamic research environment during the earliest years of the program. We expect to maintain an average of 15-18 students in the program. This level of enrollment is expected to result in an average graduation rate of 3 students per year from 2016 onwards. The degree will require a minimum of 42 credit hours beyond the M.S. degree and a dissertation, approved by the dissertation committee. Each student must complete a minimum of 24 hours of coursework in the Department of Aquaculture and Fisheries. Within this minimum requirement, three hours of an ethics course will be required and up to eight hours of appropriate coursework may be substituted, with the approval of the dissertation committee, graduate coordinator, and department chair. These courses will include aquaculture-related classes in fish health, aquatic animal nutrition, aquaculture engineering, water quality, physiology, and aquaculture economics and marketing and fisheries courses such as fisheries management, population dynamics, stream ecology, ecology of fishes, and management of small impoundments. A Memorandum of Agreement has been signed with the Graduate School of the University of Arkansas for Medical Sciences (See Appendix) to allow Ph.D. students from UAPB to enroll in graduate-level courses that add depth to the aquaculture/fisheries coursework offered at UAPB. Students will also take two hours of graduate seminar, at least one hour of a teaching/extension practicum, research and thesis credit hours, and additional advanced coursework in biological, chemical, and social sciences.

Students will be expected to spend a substantial amount of time involved in research and demonstrate the ability to design and conduct high-impact research studies. Students will be engaged in research throughout their tenure in the program, and will enroll in research and thesis credit hours after completing the coursework identified in their plan of study.

Specific courses to be taken by each student will be specified in a plan of study approved by the major professor and the committee. This plan of study will ensure that the student possesses the expected knowledge base prior to standing for the preliminary examination. We expect students who enroll in the program to bring varied backgrounds and levels of preparation in aquaculture and fisheries; thus the committee will assist the student to tailor an appropriate plan of study.

Each student must satisfactorily pass a series of milestones throughout their program of study leading to the Ph.D. degree. These milestones have been developed to ensure that students have a clearly-defined path to follow and understand the direction needed for steady progress towards their degree. However, the program also includes mechanisms that allow students to adapt to changing circumstances that arise throughout many research projects, to change research projects, and to change major professors.

The first milestone is to compose a dissertation committee. This must be accomplished prior to the end of the student's first semester. The graduate committee of the doctoral student should collectively determine the number of course credits needed. The committee must meet during the first semester to review and approve the student's plan of study (unanimous approval) and to discuss preliminary plans for the research to be undertaken. The student must complete a dissertation proposal within the first 200 days of enrolling in the Ph.D. program. Failure to defend the proposal within the specified time period will result in the student losing his/her assistantship. The proposal must first be approved by the major professor and the dissertation committee one week prior to scheduling an oral public defense. Following the oral defense of the proposal, the committee will meet to discuss any changes to the proposal (the proposal must have unanimous approval from the committee). The proposal must be defended prior to the student initiating his/her research. The next major milestone is successful completion of preliminary examinations. When the student completes his/her subject matter coursework, he/she will schedule his/her preliminary examinations. These examinations will have both written and oral components. The student must pass his/her preliminary examinations at least one year prior to graduating. One dissenting vote (other than that of the major professor) from the committee is allowed for the student to pass his/her preliminary examination. Students who fail the preliminary examination twice will be dismissed from the program. The final milestone for the student is the successful completion and defense of the dissertation. The dissertation must consist of original research developed and implemented by the student. The committee must approve the dissertation, but one dissenting vote is allowed. The entire work for the Doctorate in Aquaculture/Fisheries must be completed within seven calendar years from the date of the first registration in the program. Students must maintain full-time student status to maintain their assistantship.

Admissions requirements include the following:

1. M.S. degree from an accredited institution of higher education in an aquaculture, fisheries, agriculture, natural resources, or related scientific discipline.
2. Minimum GPA during the M.S. studies of 3.0.
3. Minimum GRE of 1000 (combined verbal and quantitative).
4. Minimum TOEFL of 550 (paper-based exam), or 213 (computer-based exam) (for international students)
5. Agreement of graduate faculty member in the Department of Aquaculture and Fisheries to supervise the student and fund the dissertation research.

The program will provide graduate students a strong academic foundation and advanced training in aquaculture/fisheries at the highest level of quality and fully integrated with research ranging from controlled aquaculture to natural fisheries so that graduates are prepared for distinguished careers in academia, industry, or public service.

Documentation of Need for the Program and Student Demand/Interest:

Table 1 lists jobs and positions for which graduates with a Ph.D. degree in Aquaculture/Fisheries would be expected to be competitive. The positions listed are all available in Arkansas, at various universities, federal agencies such as the Food and Drug Administration’s National Center for Toxicological Research, the United States Geological Survey’s Cooperative Fisheries Unit, the Agricultural Research Service, and the Arkansas Cooperative Extension Service. Outside Arkansas, there are hundreds of these types of positions posted on various web sites. The presence of this program in Arkansas will provide easy access to the skills required for these positions within the state.

Arkansas leads the nation in production of baitfish, is third in catfish production, and has the nation’s largest hatcheries for hybrid striped bass, largemouth bass, Chinese carps, and sportfish. Arkansas is the birthplace of commercial warmwater aquaculture in the United States, with commercial fish farms dating back to the 1940s. It is important to note that the aquaculture businesses are family-owned businesses, with third and fourth-generation fish farmers. Aquaculture businesses are primarily small-scale businesses, with 97% of baitfish farms, 89% of catfish farms, and 91% of other foodfish farms classified as small businesses by the Small Business Administration. Impact studies have shown significant upstream and downstream economic development effects from aquaculture in Arkansas. Much of this economic development occurs in the Delta region that is characterized by high unemployment and high rates of poverty.

The aquaculture and fisheries sectors face a variety of challenges. Low-priced imports, the spread of new diseases, and a climate of increasing regulations call for expansion of research initiatives to continue to develop productivity-enhancing solutions. These small-scale businesses do not have the research and development capability to address these challenges on their own. The growing volume of seafood imports, already the second largest commodity imported into the United States, requires expanded research for the U.S. industry to remain competitive and to support domestic job creation. The Delta region in Arkansas and Mississippi has benefited the most of any region from aquaculture. Security of food supplies and health are also at stake in keeping fish farming viable and growing.

The Aquaculture/Fisheries Center at UAPB is recognized as one of the top programs in aquaculture/fisheries, nationally and internationally. It is the only graduate program in the state specifically focused on aquaculture/fisheries and has responsibility for conducting research and extension in aquaculture/fisheries for the state. UAPB is one of the few aquaculture programs nationwide with an emphasis on production aquaculture. The Center enjoys strong support by the state and the industry. Graduates have been placed in major university doctoral programs, at state and federal levels, and in the private sector. The success of the masters program has demonstrated the need for additional trained professionals and qualified doctoral graduates with UAPB's stakeholder-driven focus. The unique perspective of the center and its accountability to stakeholders, confers a unique training opportunity and outlook to its graduates in fisheries as well as aquaculture. Many of these comments will be found in the letters of support to be found in the appendix. This focus is appreciated and well-known in the industry, government and academic community.

The UAPB program is the only major aquaculture/fisheries program in the U. S. that has experienced growth in recent years. In the last 15 years, faculty numbers have doubled, a masters program with 15-20 students was added, and the availability of full scholarships has attracted interest nationwide in the undergraduate program. Yet UAPB, along with other aquaculture and fisheries programs around the country, has struggled to find qualified Ph.D. candidates to fill faculty positions. Trained experts to supply research positions being vacated by retiring professionals and leadership roles will have to come from Ph.D. programs. While fisheries programs are more numerous nationwide, none in the state offer a Ph.D. explicitly in aquaculture/fisheries. There is a clear need to increase the pool of aquaculture/fisheries scientists at the Ph.D. level. There is growing concern over the impending retirement of many fisheries professionals over the next 5-10 years. These individuals were hired during an expansion phase of the Fisheries professionals in the 1960s (Kohler 2006).

The addition of a Ph.D. program to the Aquaculture/Fisheries Center would benefit the department by attracting top-quality students from around the country with an established set of research skills. These would enable the faculty in Aquaculture and Fisheries to conduct more in-depth and longer-term research. This would be expected to increase the number of research studies conducted each year, increase the output of refereed publications, but more importantly produce solutions to more stakeholder problems each year. The program is also expected to benefit the state by supplying trained professionals and applied research and would benefit the country by an enhanced pool of qualified doctoral graduates with the UAPB focus.

The 5-year strategic plan for the Center includes development of the Ph.D. program as well as maintaining its high-quality master's program (Appendix B includes the current strategic plan of the Center for 2007-2011). The success of the masters program in attracting international and national students and in placement of students in aquaculture/fisheries careers provides a strong foundation from which to develop the Ph.D. program.

Additional support comes from former students and local and regional groups concerned with increased expertise at UAPB. In a poll of graduating and graduated masters' students, response was positive for a Ph.D. program. The Catfish Farmers of Arkansas and the Arkansas Bait and Ornamental Fish Growers Association strongly support the development of this program. Arkansas Farm Bureau policies have included support for the Ph.D. degree in Aquaculture/Fisheries at UAPB for many years.

Local officials are looking to the university for community revitalization and renewal. The University of Arkansas at Pine Bluff and the City of Pine Bluff are proposing the creation of a Center for Aquaculture and Fisheries located on the west shore of Lake Saracen. This will be the third vertex of the Lakeshore Development Initiative of the City. The Governor Mike Huckabee Delta Rivers Nature Center and the Lakeshore Pavilion, on the other sides of Lake Saracen, compose the other two anchors of this development triangle. This major development step on the west shore of the lake will advance the City's efforts to turn Lake Saracen into a developmental focal point to attract both additional tourism and business. This facility will provide new opportunities for collaborative educational programs with the Arkansas Game and Fish Commission and will be an integral part of the City's overall efforts to become a destination point for tourists coming to Arkansas.

The new facility will provide adequate space for a visiting professor program that will bring seminars and workshops to Pine Bluff, and conferences. The distance education technologies to be incorporated in the building will provide a gateway into global aspects of many problems facing the aquaculture industry and natural resource managers. This facility will provide access for students to the most sophisticated aquaculture/fisheries facility in the nation, with a natural aquatic laboratory (Lake Saracen) in its backyard and will help position UAPB to attract top students from across the U.S. for its B.S., M.S., and Ph.D. programs.

Program Goals, Objectives, and Student Learning Outcomes:

The overall goal of this program is to offer a superior Ph.D. degree program in Aquaculture/Fisheries. Specific objectives include:

1. To train students in designing, conducting, and synthesizing high-impact research studies that address stakeholder-identified problems and contribute to the aquaculture/natural fisheries scientific base.
2. To provide superior training in oral, written, and computer-based communication skills to make Ph.D. graduates competitive for top quality professional positions.
3. To provide a continually-updated curriculum that is relevant to the current technology status and issues related to aquaculture and fisheries.
4. To ensure that the Ph.D. Degree program meets the criteria established by the U.S. Aquaculture Society, a subchapter of the World Aquaculture Society, and the American Fisheries Society for Ph.D. programs.

Learning outcomes include:

1. Strong theoretical and empirical skills in aquaculture sciences and management.
2. Strong theoretical and empirical skills in fisheries science and management.
3. In-depth expertise in the application of state-of-the-art analytical techniques germane to aquaculture/fisheries research.
4. Innovative and effective teaching techniques and methods that address a variety of learning styles.
5. Ability to design and implement a productive research program in aquaculture and fisheries.
6. In-depth understanding and ability to implement problem-solving programs that target stakeholder-identified needs.

Program Curriculum and New Course Descriptions:

Ph.D. students will be expected to develop in-depth, comprehensive knowledge in a specific core content area. However, students will also be expected to develop basic familiarity with the principles of areas related to their core content area. Table 2 presents a listing of the core and related areas. The common portion of the written preliminary examination will test for this basic familiarity with principles in all areas, while the remaining portion of the written component and the oral examination will focus on the specific core content area of each student, as identified by the student's committee. Each student will develop a program of study that will ensure an adequate mix of coursework and activities that will prepare the student to be successful in their preliminary examinations and to be able to teach an undergraduate course in the core and related areas. A course in research ethics will be required for all Ph.D. graduates. Several options are available at UAMS.

Curriculum Outline

Courses Currently Available. Content areas currently available at the graduate level include: water quality, fish nutrition, fish health, aquaculture production, economics and marketing, aquatic animal physiology, fisheries management, population dynamics, statistics, stream and fish ecology, and research methods. Syllabi are included in Appendix C. Specific courses currently offered are listed in Table 3. Course offerings have been expanded gradually over time, both to strengthen the M.S. program, but also to prepare for the Ph.D. program. The courses offered currently cover the basic core of subject matter in the areas of aquaculture and fisheries. These courses include:

GAQF 5300 Research Methods and Scientific Writing 3 Credits (2 hrs. Lecture, 3 hrs. Lab)
The two main objectives of this course are: 1) to familiarize students with planning and execution of scientific experiments and 2) to enable students to convey research results effectively through written communications. Students will learn general principles of scientific writing and how to conduct literature searches. Different formats of written communications pertinent to aquaculturists and fisheries biologists will be examined (e.g. peer-reviewed journal

articles, extension and trade publications, government documents). Offered spring semester of every year.

GAQF 5405 Statistics in Research 4 Credits (3hrs. Lecture, 3 hrs. Lab)
This course will cover the fundamentals of basic statistics and analytical techniques that are needed for scientific research data analysis. The statistics taught in this class will range from descriptive statistics, simple t-test, ANOVAs, to linear regression. Theories and applications of statistics will be demonstrated and taught through use of real-world examples. Offered fall semester of every year.

GAQF 5406 Univariate and Multivariate Models in Fisheries Science 4 Credits (3 hrs. Lecture, 3 hrs. Lab)
This course will cover models that are developed to deal with univariate and multivariate data analysis. The statistical modeling techniques taught in this class include multiple regressions, model selection methods, logistic regressions, multivariate ANOVAs, ordinations, and classification analyses. Theories and application to real-world examples will be used to understand the statistical methods. The laboratory session will focus on the application of the models for specific uses. Offered spring semester of even years.

GAQF 5407 Experimental Design and Analysis 4 Credits (3 hrs. Lecture, 3 hrs. Lab)
The success of research studies starts from good planning of research design. This course addresses the needs of graduate students preparing for a career in agricultural and aquaculture research as professional scientists in the subjects of design, plot layout, analysis and interpretation of laboratory and field experiments. Many numerical examples and problems will be presented, and the recitation through homework assignments will allow students to explore analysis. Laboratories will be devoted to practical applications and exercises. Offered spring semester of odd years.

GAQF 5208 Nonparametric Methods in Data Analysis 2 Credits (2 hrs. Lecture)
Parametric statistics, such as t-test and F-tests, require very rigorous parametric assumptions about the underlying distribution of populations. However, we often deal with data that do not satisfy the restrictive parametric assumptions of sufficient sample size that are crucial for accurate and unbiased statistical inferences. This course will introduce alternative nonparametric statistical methods that can be used in the analysis of data that do not meet parametric statistical assumptions. Offered summer session II of even years.

GAQF 5311 Advanced Aquaculture 3 Credits (3 hrs Lecture)
Students will learn the biological, chemical, and physical bases, determinants and limitations of production systems and major species. Climatic influences will be discussed. Special consideration will be given to species of regional importance and elements of hatchery management and fish genetics. This course is needed by all aquaculturists. Offered spring semester of odd years.

GAQF 5310 Program Evaluation and Survey Methods 3 Credits (3 hrs. Lecture)
This course will cover the fundamentals of program evaluation and survey methodologies. Evaluation models such as systems analysis, behavioral objectives, and goal-free will be studied.

The construction, design, and implementation of questionnaires using a sound scientific approach will be covered in depth. Offered spring semester of odd years.

GAQF 5414 Ecology of Fishes 4 Credits (3 hrs Lecture, 3 hrs. Lab)
Students will learn the fundamental concepts of ecology. Students will learn specific life history requisites of native Arkansas fishes and how they interrelate with habitat parameters. Students will also be introduced to simplistic habitat modeling techniques. This course is recommended for students with the goal of working in natural resource management or research. Students should have taken a course in ichthyology that emphasized taxonomy of fishes. Offered spring semester of even years.

GAQF 5315 Extension Methodology 3 Credits (3 hrs. Lecture)
This course will cover the history and mission of the land-grant system with particular emphasis on Extension. Extension community needs assessment, program development, implementation, and evaluation will be covered. Extension methodologies for technology transfer will be covered in depth. Strongly recommended for all aquaculture/fisheries students. Offered summer of even years.

GAQF 5420 Fish Physiology 4 Credits (3 hrs. Lecture, 3 hrs. Lab)
This course will impart an understanding of the organization of diverse physiological systems that enable fish to flourish in diverse aqueous and marine environments. The course begins with an examination of energy mobilization and a thorough overview of the systems responsible for the maintenance of homeostasis. In the second part of the course sensory biology and the neuroendocrine system are presented to illustrate how environmental signals are integrated and responded to. Finally, examinations of examples of applications of fish physiology to fisheries management and aquaculture will be presented.

GAQF 5220 Engineering and Construction of Aquaculture Facilities I 2 Credits (3 hrs. Lecture, 3 hrs. Lab)
This course will cover site selection and construction of levee and watershed ponds, repairing levees and ponds, cage construction and placement, in-pond raceways, aeration, and pond effluents. Strongly recommended for all aquaculture students. Offered summer semester I of odd years.

GAQF 5221 Engineering and Construction of Aquaculture Facilities II 2 Credits (3 hrs. Lecture, 3 hrs. Lab)
This course will cover degassing mats, pumps, open channel and piping systems, transportation, and management, and components of recirculating aquaculture systems with fish only and with fish integrated with plant production. Offered summer semester II of odd years.

GAQF 5322 Aquaculture Economics 3 Credits (3 hrs Lecture)
Aquaculturists need to be able to develop, interpret, and use results of economic analyses to improve economic and financial performance of aquaculture businesses. The course will cover the application of economics and financial analysis techniques in aquaculture. Enterprise budgets, balance sheets, income statements, cash flow budgets, loan management, risk analysis,

and business plan development are included. No prior background in economics and marketing is required. Offered fall semester of odd years.

GAQF 5323 Aquaculture Marketing 3 Credits (3 hrs. Lecture)
Aquaculturists need to understand how to develop a marketing plan and interpret results from marketing research. This course will cover key marketing concepts, functions, channels, and strategies. Examples will be focused on the aquaculture industry. No prior background in economics and marketing required. Offered fall semester of even years.

GAQF 5324 Quantitative Methods in Fisheries and Aquaculture Economics 3 Credits (3 hrs. Lecture)
This course will introduce students to quantitative methods used to: 1) identify consumer preferences; 2) estimate demand for either an aquaculture product or a non-market good or service; 3) willingness-to-pay techniques; 4) contingent valuation; 5) logit analysis; and hedonic analyses. Offered spring semester of even years.

GAQF 5325 Fish Population Dynamics 3 Credits (3 hrs. Lecture)
Students will learn theoretical aspects of population dynamics. The course focuses on the use of standard mathematical models in estimating fish population size, recruitment, production, and yield. Some modeling applications are explored through standard computer software and programming for model derivation and applications. Offered fall semester of even years.

GAQF 5430 Fish Health Protection 4 Credits (3 hrs. Lecture, 3 hrs. Lab)
Fish diseases are a major factor governing the management of natural fisheries and diseases also have a significant impact on commercial aquaculture. In this class, students will learn disease diagnostic techniques from microscopy to PCR, survey the major diseases of wild and cultured fish, and learn about the relationships between fish disease and regulatory actions. Additional lectures will cover shrimp and shellfish diseases. The laboratory portion of the course is conducted in the UAPB Fish Disease Diagnostic Laboratory and requires students to diagnose, document, and report on fish disease cases. Offered spring semester of even years.

GAQF 5435 Management of Small Impoundments 4 Credits (3 hrs. Lecture, 3 hrs. Lab)
Students will learn the principles that govern the management of small impoundments for recreational fishing. Students will learn about species balance, population balance, field techniques to assess balance, and methods to correct unbalanced populations. Labs will be field trips to ponds in Jefferson and adjacent counties to assess the balance of farm ponds; to make recommendations about their balance; and to formulate solutions to unbalanced populations. This course is needed by extension biologists, aquaculturists, and research biologists. Offered spring semester of even years.

GAQF 5336 Aquatic Animal Nutrition 3 Credits (3 hrs. Lecture)
This course covers metabolism and nutritional requirements of fishes and other aquatic animals. Biochemical concepts of nutrient utilization will be discussed. Emphasis is on the differences between nutrient use and requirements of aquatic animals versus terrestrial ones. This course is needed by aquaculture students. Offered fall semester every year.

GAQF 5136 Aquatic Animal Nutrition 1 Credit (3 hrs. Lab)
This course covers laboratory analytical procedures relevant to fish nutrition studies (protein, lipid, dry matter, ash, etc.). Students will also initiate and maintain a group project (usually a feeding trial) to gain practical experience in methods used to determine nutrient requirements or optimal feeding strategies for different fish species. Offered fall semester every year.

GAQF 5441 Aquatic Chemistry and Analysis 4 Credits (3 hrs. Lecture, 3 hrs. Lab)
This course will provide students with an understanding of (a) the fundamental chemical principles affecting water quality in aquatic environments, (b) the biological, chemical and physical processes that affect water quality, (c) skills required to evaluate water quality problems with basic analytical and laboratory skills. Offered fall semester of even years.

GAQF 5445 Stream Ecology 4 Credits (3 hrs. Lecture, 3 hrs. Lab)
Students will learn about the chemical, physical and biotic factors that affect stream organisms and will also learn how aquatic ecosystems function. Stream organisms have developed adaptations to cope with such systems. Stream habitat management, impact assessment, and habitat modeling will be emphasized. Hydrologic data interpretation will be integrated into field exercises. This course is recommended to acquire an understanding of stream hydrology and dynamics and is necessary for students who embark on careers with regulatory or management functions. Offered fall semester of odd years.

GAQF 5371 Fisheries Management 3 Credits (3 hrs. Lecture)
Students will learn about fish population in streams, reservoirs, lakes and oceans and will also learn techniques and methods to assess and manage these populations. This course is needed by all fisheries biologists. Offered spring semester of odd years.

GAQF 5341 Water Quality Management 3 Credits (3 hrs Lecture)
This course covers the management of water quality in commercial fish ponds, farm ponds, impoundments, and streams. Students will apply water chemistry to management goals for various water bodies. This course is needed by all aquaculture and fisheries scientists.

GAQF 5390-5391 Special Topics 3 Credits
This course is offered as a forum to cover timely and topical issues that affect aquaculture and fisheries as they arise. Examples of such issues include aquatic vegetation, aquatic toxicology, and mathematical programming.

GAQF 5195-5196 Graduate Seminar 1 Credit
Seminars will be presented each week by faculty, staff, students, and guest lecturers. Approaches will include recent perspective and historical overviews as well as critiques of recent research in applied and natural fisheries. Offered spring and fall semesters of every year.

GAQF 5198-5398 Graduate Research Problems 1-3 Credits
This project-oriented course offers advanced studies in aquaculture and fisheries. The course provides the opportunity for students to obtain specialized skills or undertake research in areas outside the scope of the student's thesis research. Class activities are arranged in advance with instructors amenable to supervising this course. The amount of credit offered for this course will

vary from 1-3 credit hours and depend upon the scope of the project. Credit offered for the course and scope of the project would be determined prior to registration. A research problems outline approved by the course supervisor, graduate committee, and graduate coordinator must be submitted with the program of study.

GAQF 5129-5999 Research and Thesis 1-9 Credits

<u>New Content Areas and Courses Proposed to be Offered in the Department of Aquaculture and Fisheries</u>.

For the Ph.D. program, several additional new courses will be added to the curriculum to strengthen the overall core of courses that are already available. These new courses will include: population modeling, reservoir fisheries and ecology, reproductive physiology and hatchery applications, genetic principles and applications in fisheries, and a teaching practicum. Descriptions of the new courses to be offered are included below (Table 4).

GAQF 5340 Integrative Fish Hatchery Science 3 Credits (2 hrs Lecture, 3 hrs Lab)
An integration of the concepts of basic biology of aquaculture species and hatchery techniques will be presented. Current finfish hatchery practices will be presented in a physiological context and in a quantitative fashion. Students are expected to develop a skill set that can be applied to the development of new hatchery protocols adapted from active areas of aquaculture research. Offered every other year.

GAQF 5345 Genetic Principles and Applications in Fisheries and Aquaculture 3 Credits (3 hrs Lecture)
The goal of this course is to provide students the tools to understand and evaluate the use of genetic approaches for fisheries management and aquaculture. Chromosomal, biochemical, quantitative and ecological aspects of fish genetics will be presented with emphasis on their application to aquaculture and fish management. This course is needed by all fisheries and aquaculture biologists. Offered every other year.

GAQF 5326 Fisheries Modeling 3 Credits (3 hrs Lecture)
Students will learn to use a variety of statistical models commonly employed in fisheries science and ecology. Both deterministic and stochastic models will be employed that pertain to mainstream concepts in fish population dynamics and ecology. Examples of topics include virtual population analysis, fish bioenergetics, modeling fish-environment relationships, and models used for fish community analyses. Offered fall of odd years. Prerequisites: GAQF 5325, GAQF 5405 (or equivalent statistics course)

GAQF 5335 Reservoir Fisheries and Ecology 3 Credits (3 hrs Lecture)
This course will provide an in-depth look at the limnology, ecology, and management of reservoir systems. Students will learn reservoir physical/chemical properties, processes, and dynamics; trophic aspects; and specialized management issues. Students will be able to compare and contrast reservoir systems with lakes and rivers, and will be expected to present seminar topics to their peers. This course will be needed by all fisheries biologists and will be offered spring of odd years.

GAQF 5336 Ecology of Caribbean Reef Fishes 3 Credits (2 hrs Lecture, 3 hrs Lab)
This course will introduce students to the biology and ecology of Caribbean reef fishes. The course will be needed by fisheries biologists interested in working in marine environments and will be offered every other summer. It will involve three weeks of intensive work in Pine Bluff and two weeks of field work. Students will be required to pay their own expenses for the field work (transportation, room, board, dive fees, and equipment rental) in addition to tuition. Prerequisite: Students must be SCUBA certified prior to the class.

GAQF 5v71-75 and 5v81-85 Teaching/Extension Practicum
Each Ph.D. student is required to take at least 1 hour of this course to gain experience in teaching and/or extension. Students who intend to pursue a career in either a university teaching or extension specialist position may choose to take more hours or take it twice (with a second number). The number of hours taken will be specified in the student's plan of study.

Students in the Ph.D. program in Aquaculture/Fisheries may also take courses outside of the areas of aquaculture and fisheries, to provide additional overall depth. Table 5 lists graduate courses currently offered by other departments at UAPB, and Table 6 lists relevant graduate courses available at the University of Arkansas at Little Rock, the University of Arkansas at Monticello, and the University of Arkansas for Medical Sciences. These campuses are located within 1 hour's drive of UAPB. In addition, the existing Special Topics class provides a mechanism to cover specific study areas of particular interest to students, but not offered as full courses on campus. These may include topics such as population or conservation genetics, bioinformatics, behavioral or stress physiology, physiology of disease, epidemiology, bioenergetics, fatty acid signatures, otolith microchemistry, or isotope analysis.

List of Program Faculty (Names and Credentials):

The Center is recognized for both its scientific contributions and its impacts on the aquaculture industry. In 2005, the Center was selected for the 1890 AEA/ARD System-Wide Integrated Award for the level and scope of its research and extension activities. Individual scientists in the Center have received the highest awards from aquaculture industry associations in the state and nationally for their contributions (Table 6). The following prestigious awards have been made to Center faculty: 1) Researcher of the Year, Catfish Farmers of America, 2) McCraren Awards (4) from the National Aquaculture Association, three different scientists 3) Outstanding Service Awards from the Catfish Farmers of Arkansas and the Arkansas Bait and Ornamental Fish Growers Association, and the Harvey McGeorge Distinguished Award of Service to Agriculture (other recipients include Sen. Dale Bumpers, Rep. Marion Berry, and others).

Over the past 5 years, three different faculty in Aquaculture/Fisheries had papers selected for Best Paper of the Year by two different journals, Journal of Aquatic Animal Health and the North American Journal of Aquaculture. Moreover, UAPB Aquaculture/Fisheries Center faculty won first place in two of the five categories at the 2005 joint meeting of the Association of 1890 Extension Administrators and the 1890 Association of Research Directors. At that same meeting, the UAPB Aquaculture/Fisheries Center was awarded the 1890 System-Wide Integration Award.

Graduate and undergraduate students and faculty have also received a variety of awards at professional association meetings over the years (Tables 7, 8). Receipt of these awards has generated a positive reputation for the quality of graduates of the Masters of Science in Aquaculture/Fisheries and the B.S. degree in Fisheries Biology. As a result, many employers actively recruit UAPB Aquaculture/Fisheries graduates for positions that will be opening, often in advance of the opening itself.

Center personnel collaborate with a large number of other universities and agencies throughout the United States and overseas and serve on a number of federal task forces that address policy issues of national importance (Appendix D). Of great recent importance is the Center's role in assembling and interpreting scientific data for federal regulators making decisions in areas with the potential to have devastating economic impacts on the aquaculture industry (e.g. Environmental Protection Agency on effluents, U.S. Fish & Wildlife Service/U.S. Geological Survey on exotic species, Animal Plant and Health Inspection Service on fish pathogens).

Table 9 lists faculty currently hired in the department, along with one position vacancy. There are a total of 14 Ph.D.-level faculty positions in the Aquaculture/Fisheries Center. Scientists lead research programs in fish health, fish nutrition, pond and hatchery management, water quality, fish physiology, economics and marketing, engineering, small impoundments (farm ponds and reservoirs), fisheries management, and larval fish ecology. The Center is known for its many dedicated and talented faculty members. Research faculty in the Center are the primary sources of fish diagnostic services in Arkansas, fish nutrition, aquaculture economics and marketing research information in the U.S., and the principal source of information on baitfish production technologies. The following lists faculty and areas of expertise and general program areas:

Dr. Carole Engle – Director/Professor, Auburn University
General Program Area: Aquaculture economics, aquaculture marketing, aquaculture, policy issues affecting aquaculture, catfish production, Asian Carps

Dr. Andrew Goodwin – Associate Director/Professor, Auburn University
General Program Area: Fish diseases, parasites, virology, water quality, diagnostics, animal identification, therapeutants

Dr. Nathan Stone – Extension Fisheries Specialist / Section Leader, Auburn University
General Program Area: Aquaculture, water quality, effluents, farm pond management, baitfish production, alternative & small scale production

Dr. Madan Dey – Professor, University of the Philippines
General Program Area: Aquaculture marketing, international trade

Dr. Michael Eggleton – Associate Professor, Mississippi State University
General Program Area: Quantitative fisheries science, population dynamics

Dr. Alf Haukenes – Assistant Professor, University of South Dakota
General Program Area: Fish physiology, reproductive physiology, stress physiology

Dr. Anita Kelly – Extension Aquaculture Specialist, Southern Illinois University
General Program Area: Fish health, pathology

Dr. Rebecca Lochmann – Professor, Texas A&M University
General Program Area: Fish nutrition, lipids, nutrition, immunity

Dr. Steve Lochmann – Associate Professor, Texas A&M University
General Program Area: Larval fish ecology, recruitment of largemouth bass in Arkansas River

Dr. Peter Perschbacher – Associate Professor, Texas A&M University
General Program Area: Aquaculture, phytoplankton analyses

Dr. Hugh Thomforde – Extension Aquaculture Specialist, Auburn University
General Program Area: Aquaculture, water quality

Dr. Lin Xie – Assistant Professor, Kansas State University
General Program Area: Biostatistics of aquaculture and fisheries

Dr. Yushun Chen – Assistant Professor, West Virginia University
General Program Area: Water quality

Vacant – Assistant/Associate/Full Professor,
General Program Area: Management and ecology of farm ponds, irrigation reservoirs, and other impoundments

There currently are two post-doctoral scientists employed in research positions in the Center. These are:

Dr. Todd Sink – Postdoctoral Scientist, University of Tennessee
General Program Area: Aquatic animal nutrition and physiology

Dr. Kehar Singh – Postdoctoral Scientist, Punjab Agricultural University, Ludhiana, India
General Program Area: Aquaculture marketing, demand and trade analysis

Appendix E includes the curriculum vitae of current faculty.

Faculty hold terminal degrees (Ph.D.) in their respective areas of expertise. Several faculty members are recognized nationally and internationally for their discoveries and scientific achievements. Others have studied with nationally and internationally-renowned aquaculture and fisheries scientists and did their Ph.D. work at the top aquaculture and fisheries universities in the U.S. These include Auburn University, Texas A&M University, Mississippi State University, Kansas State University, Southern Illinois University, and the University of South Dakota.

Faculty members conduct high quality problem-solving research, as evidenced by the combination of stakeholder support and publications in refereed journals. Faculty are productive in terms of research output, but also focus on practical solutions to current stakeholder problems. Faculty have a strong peer reviewed publication record, many in top journals in the field. Figure 1 shows the number of refereed journal articles. Publishing research results in internationally recognized peer reviewed journals establishes a permanent record of research results and makes findings available over the long term to others in the scientific community. Over the past 5 years, scientists in the UAPB Aquaculture/Fisheries Center have published, on average 25.6 refereed journal articles a year, many of these in journals considered to be the top journals in the field (Figure 1). Based on the 5-year average of publications, this would be 4.7 refereed journal articles per research F.T.E. (2.6 per faculty member on a research appointment).

A copy of the Publications List is appended (Appendix F). Over the past 5 years, the Aquaculture/Fisheries Center has averaged 125.6 presentations a year at scientific meetings.

The most significant research accomplishments of the Center in recent years include the following:

1. Development, over a 10-yr period, of the indoor hatching of baitfish species. This technology has led to a major transformation of the baitfish industry from extensive mat spawning in ponds to indoor hatching and spawning. The technology is scale-neutral and has been adopted by nearly all baitfish growers in Arkansas with out-of-state growers now beginning to adopt it also. The savings and impact in terms of improving productivity and efficiency on farms have been substantial.

2. UAPB's patented in-pond floating grading technology, has been adopted widely by catfish fingerling producers (now advertising "precision-graded fingerlings") and by a number of foodfish growers.

3. The discovery of Spring Viremia of Carp, first reported in the U.S. by the UAPB Aquaculture/Fisheries Center, is considered by many to be the most significant fish health finding in a decade. More importantly, UAPB scientists worked diligently to develop the disinfection protocols and an indemnification program for the North Carolina farm where the disease was first discovered. The long-term screening programs in Arkansas conducted by the Aquaculture/Fisheries Center have also clearly documented the absence of the virus in Arkansas.

5. Economic analyses conducted by Center economists are used as the fundamental basis for aquaculture economics in the U.S. Economics models developed by Center economists are used routinely by policy makers at the state and national levels.

Appendix G includes an overview of research and extension in the Department and in the Center.

One of the Center's strengths is the nearly seamless integration of research and extension. The integrated nature of the Center provides for excellent communication among the research, teaching and extension programs. All three components are involved in various center activities, such as the bi-annual Field Day and the annual Aquatic Sciences Education Day. Another strength of the Center's faculty is their strong ties to the aquaculture industry, to national aquaculture associations, and to national and international agencies involved in aquaculture regulation. The credibility of the Center with its stakeholders has resulted in strong aquaculture industry support.

The UAPB Aquaculture/Fisheries Center provides a unique opportunity to train scientists for the position of extension aquaculture specialist. These positions require a Ph.D. degree in most states, but few recent Ph.D. graduates have training and experience in extension methodologies. The seamless level of integration of research and extension in the Center provides such an opportunity. The 7.9 FTE (faculty) in aquaculture extension in the Center provide ample mentoring opportunities for Ph.D. students. The annual workshops and educational meetings held in the state in cooperation with the Catfish Farmers of Arkansas and the Arkansas Bait and Ornamental Fish Growers Association, the field demonstrations, the Arkansas Aquaculture Field Day, and ongoing extension educational programs provide many opportunities for training for these positions.

Majority Extension faculty are listed in Table 8 along with general program areas, and current priority programs. Additional faculty support for Extension is included in three individuals with partial extension appointments (< 50%) in specialized areas that include: fish health (Dr. Andrew Goodwin), farm pond and reservoir management, and aquaculture economics and marketing (Dr. Carole Engle). Four specialists are located off-campus in Lake Village, Lonoke, and Newport, Arkansas. Lake Village is central to commercial catfish production in the state, with the majority of acreage located within a radius of 50 miles. The majority of baitfish and sportfish production is near Lonoke. Based on the results of a producer survey conducted as part of a NE Arkansas aquaculture plan, a specialist was located in NE Arkansas to support area producers. Through a cooperative agreement, the specialist is housed on the campus of Arkansas State University at Newport (an example of cooperation between the UA and ASU systems.). One UAPB-based specialist is devoted primarily to the catfish and baitfish research verification program, and another works in the area of aquaculture equipment development.

Aquaculture/Fisheries Center faculty have mentored and graduated over 85 M.S. graduate students since 1997, when the first graduate student enrolled in the M.S. degree program in Aquaculture/Fisheries. Appendix H includes experience of faculty in supervising and mentoring graduate students as thesis advisor. Each student has at least two other members on his/her thesis advisory committee. Figure 2 shows that UAPB has graduated, on average, 4.4 M.S. students per year over the past five years. Of these, 32% have pursued Ph.D. degrees and 71% of the rest are working in positions directly related to their training in aquaculture/fisheries (Appendix H). Graduation rate is approximately 89%.

Appendices I and J list recent productivity of both M.S. and B.S. students including student publications, abstracts, and presentations for 2000-2010. M.S. graduate students have published 1.45 refereed journal articles/graduate student, 3.45 total publications per graduate student. Ninety-two percent of graduate students have at least one publication, 85% publish at least 1 refereed publication, and 74% publish at least 1 refereed journal article.

Description of Program Resources (Library, Instructional Equipment and Facilities, Technology Support):

Library Resources

Library resources available to faculty and students in the Aquaculture/Fisheries Center at UAPB include all the major scientific journals in the areas of aquaculture and fisheries and the majority of the relevant books. The journals are available through online subscriptions that allow faculty, staff, and students to access full-text scientific literature from their desk and laptop computers. Access includes a good collection of journals and books in related areas of biology (including bacteriology, parasitology, and immunology), chemistry, nutrition, economics, marketing, and ecology, among others.

Existing aquaculture and fisheries literature collections at UAPB are comprised of holdings at Watson Memorial Library and departmental holdings. John Brown Watson Memorial Library, the main library, hosts 30 online databases with access to over 100,000 full-text journals and newspaper articles, many peer-reviewed, from any computer on campus and for distance access, where applicable, with an ID and password. The main library houses a volume equivalence of 361,502 holdings: 185,955 print volumes and 175,547 microform. 730 print journals with retrospective journals in bound volumes an don microfilm are also available to patrons. The Online Public Access Catalog (OPAC) accesses all print holdings in the mail library and AFREL and is accessible through UAPB's and AFREL's web sites. A keyword search of Aquaculture and Fisheries in OPAC will yield 11,080 titles under the following subject headings: Agriculture 491, Aquaculture/Fisheries 281, Aquatic Animal Nutrition 641, Biology 631, Chemistry 631, Ecology/Environmental Sciences 1631, Economics/Marketing 1581, Fisheries Management 2,441, Medical Sciences 1,931, and Water Quality 821.

The department's combined collection of 955 books, 159 aquaculture/fisheries and 622 science periodicals, are housed in the newly-formed and operational satellite library resource center located in Woodard Hall. This center was funded originally through a USDA Capacity Building Grant, but expenses, including staffing are now included in the Watson Memorial Library's budget. The next largest collection of aquaculture and fisheries materials is at the nearby USDA/ARS Southern National Aquaculture Research Center (SNARC) laboratory library, located 45 miles from Pine Bluff in Stuttgart, AR. It contains 579 books, 211 monographs and 98 periodicals/databases and indexes.

In addition, the libraries at the National Center for Toxicology Research (NCTR) (Food and Drug Administration), University of Arkansas Medical Sciences (UAMS), and the University of Arkansas at Little Rock (UALR) are available to UAPB faculty and students. Total holdings of these libraries include:

NCTR: 12,000 monographs, 600 databases, and 250 current titles in microbiology, genetics, reproductive and developmental biology, chemistry, neurotoxicology, biochemical toxicology, molecular epidemiology, biometry and risk assessment.

UAMS: 43,000 book volumes, 3,463 periodical subscriptions with 125,097 bound journal volumes, and 6 special collections

UALR: 11,000 electronic book titles, 28,000 electronic journals, 3,600 active periodical subscriptions, 115 electronic databases, and more than 1 million microforms.

Institutional Equipment and Facilities

The Aquaculture/Fisheries Center of Excellence and Department have abundant equipment and facilities resources to support the Ph.D. program. UAPB has the 3rd largest warmwater aquaculture research facility in the U.S. A number of new research laboratories have been constructed in recent years to develop the capacity to add Ph.D. students into the research program. In all, there are 124 earthen ponds located on 235 acres of land, 40 pools, and 12 vats and raceways. In addition to the outdoor pond, pool, tank, raceway, and vat facilities, there are over 21,000 square feet devoted to indoor laboratory facilities. The indoor laboratories include a mix of bench-type dry laboratory space for analytical work and wet laboratories with a variety of aquariums, tanks, and recirculating tank research systems for trials with live fish.

Extension, Research, and Teaching facilities are located in the following areas (a virtual tour is available at www.uaex.edu/aqfi):

1. Aquaculture Research Station
2. S. J. Parker Agricultural Research Complex
3. S. J. Parker Extension Complex
4. Woodard Hall
5. Holiday Hall Applied Sciences Building
6. UAPB Lonoke Farm
7. Lake Village Diagnostic Laboratory
8. Lonoke Diagnostic Laboratory
9. Newport Diagnostic Laboratory

1. Aquaculture Research Station

The Aquaculture Research Station is located on 200 acres of land one mile north of the UAPB campus. There are currently 113 earthen ponds including a 5-acre reservoir that supplies water to the remaining 112 research ponds. About one-third (35 ponds) are 0.1 acre in size and 14 of these are covered with bird netting to exclude predators from minnow studies. There are five 0.5-acre ponds for holding and spawning purposes. A 1-acre pond is used for small impoundment demonstration. The remaining 71 ponds are 0.25-acre and provide the bulk of experimental and holding facilities at the station. Water to the reservoir is supplied by two shallow wells. Water may also be supplied directly to most ponds by a deep-water nearly iron-free well.
Further research may be conducted in 40 9-foot diameter pools covered with bird netting. This unit is frequently used for nutrition and pilot studies with minnows and ornamental fish. A hangar covers 8 holding tanks or vats used for holding, grading, or otherwise processing fish. The vats are 15 feet long by four feet wide by four feet high. Twenty-one of the original (40-yr

old) 0.25 acre ponds were rebuilt in 2010 with upgraded electric, drainage and water supply lines. The primary hatchery building was renovated also in 2010.

Buildings on site include the following:

A. Aquaculture Equipment Development Building
B. Aquaculture Research and Demonstration Building
C. Feed Building
D. Hatchery
E. Maintenance Building
F. Storage Facility
G. Value-Added Product Development and Demonstration Building
H. Water Chemistry Laboratory
I. Truck Shed

A. Aquaculture Equipment Development Building (AEDB)

The Aquaculture/Fisheries Center of Excellence at UAPB is committed to improving profitability on fish farms. New aquaculture equipment and processes are being developed to improve management capabilities and reduce labor. Projects include the development of in-pond grading equipment, a seine reel designed to sanitize harvesting nets, an improved seine boat designed to improve the crowding and handling of fish at harvest and a hydraulically-powered trawl system for sampling commercial ponds. The 1,800 square foot shop building is equipped with welding and basic metal fabrication tools.

B. Hatchery Research and Demonstration Building (HRD)

Completed in 2005, this laboratory is designed to accommodate research and demonstrations in the areas of hatching fish and water quality. The facility is divided into two dry labs and two wet labs that can be combined or separated in a variety of permutations to allow experimentation with temperature variation from lab to lab, depending upon species under investigation.

C. Feed Building

This structure provides climate-controlled space for feed storage as well as equipment storage. Outside are two 8-ton bulk feed storage bins that auger feed into the building for dry loading onto distribution vehicles.

D. Hatchery Building

The oldest and largest building at the station (5,400 square foot), it is equipped with its own deep water well and houses a variety of tanks and systems. Catfish are hatched here for station study use. Experimental work with innovative hatching systems for a variety of minnows and goldfish is conducted. Fish are housed for teaching at UAPB and for Vo-Ag classes across the state of Arkansas. Nutrition studies are conducted in this building, and a recirculation system for nutrition research was constructed to test fish and diets under different temperatures.

E. Maintenance Building

This location provides storage for tools, hardware, and chemicals and provides resources for tractor and vehicle maintenance.

F. Storage Facility

This building provides seven 10x10 ft storage rooms for secure storage of property for researchers and projects at the station.

G. Value-Added Product Development and Demonstration Building

Built in 2000, the Value Added Product Development and Demonstration building is a multi-purpose structure with both research and extension objectives. The laboratory portion of the building is a food processing/kitchen lab where catfish, shrimp and crayfish are developed into new edibles by altering protein structure or simply utilizing innovative recipes with the normal state of the product. A second portion of the building provides an extension conference room that doubles as a break room for research station personnel on a daily basis. The building also provides shower facilities and the station's main office.

H. Water Chemistry Laboratory

This building houses state-of-the-art chemical analysis machinery. Geared to perform a variety of tests of water chemistry parameters, the laboratory houses computers, spectrophotometers, and fume hoods for chemical analysis of water.

I. Truck Shed

In addition to vehicles available from the UAPB Motor Pool, the Department maintains five trucks for field research and several trucks, tractors, ATVs, and golf carts for Station use. These vehicles are stored at the Aquaculture Research Station.

2. The S.J. Parker Agricultural Research Complex

This complex houses facilities and personnel from both the departments of Agriculture and Aquaculture/Fisheries and a conference room. Aquaculture/Fisheries facilities in the S.J. Parker main building include offices for professors, researchers, and graduate students. A wet and a dry nutrition laboratory is located in the main building; and, at the far end of the complex, the Fish Shop and Boat Barn house natural fisheries research space and equipment (described below).

Fish nutrition research at UAPB addresses the development of diets and feeding strategies for baitfish, channel catfish, hybrid striped bass, pacu, largemouth bass and tilapia. Special interests include lipid nutrition, broodstock nutrition, nutritional immunology, nutritional aspects of stress physiology and the effects of fish consumption on human health. The nutrition dry laboratory (1,000 square foot) contains a walk-in cooler, freezer and ultra-cold freezer for sample storage, equipment for diet preparation, and instrumentation for feed and tissue analysis including protein, lipid, dry matter, ash, fiber analysis, and fatty acid analysis. The wet lab (1,000 square foot) is equipped with a variety of aquaria that may be operated in either flow-through or recirculation fashion.

Support facilities for natural fisheries research include a 2,256 square foot laboratory and a 2,400 square foot boat storage facility. The Fish Shop includes a wet lab with five independent recirculation systems (8 20-gallon aquaria per system) and 20 170-liter flow-through polytanks in a light-controlled environment. There is a large equipment storage area that includes backpack electrofishing equipment, state-of-the-art tagging equipment, and ploidy manipulation equipment; and a processing laboratory that includes wet sample areas, standard microscopy, and an image analysis station. The Boat Barn contains two boom-mounted electrofishing boats and seven all-purpose aluminum boats of various sizes. Collection gears of many types are available, including gill, trap, and hoop nets, trawls, seines, purse seines, and ichthyoplankton tow nets. The Boat Barn is enclosed by a gated fence and has ample parking for vehicles and boats.

3. The S. J. Parker Extension Complex

The office of the Dean of the School of Agriculture, Fisheries, and Human Sciences is located in the complex along with various personnel in each of the component departments and the S. A. Haley Auditorium. Offices of Aquaculture and Fisheries Extension personnel stationed in Pine Bluff and the Fish Health laboratory are also located in the Extension Complex.

The Fish Health Laboratory is one of four disease diagnostic laboratories operated by UAPB that provide a variety of services to the aquaculture industry (the other three are described in items 7-9 below). The lab on the UAPB campus in Pine Bluff provides advanced diagnostic services (histology, quantitative polymerase chain reaction, pathogen identification) to the other laboratories, assists with research related fish health problems from the labs and ponds of the Aquaculture/Fisheries Center and handles a significant number of cases from out of state. The UAPB laboratory is APHIS approved to inspect fish for export and is one of the most active labs in the APHIS Farm Certification Program. Together these four laboratories handle more than 2,000 disease cases per year submitted by more than 300 farms in 27 states.

The S.A. Haley auditorium is used for presentations, keynote speeches, and safety meetings. This auditorium provides seating for up to 150 people with wired network connections for all stations. This allows for easy access to the internet or school network.

4. Woodard Hall

The second floor of Woodard Hall is home to classrooms, computer labs, teaching and graduate student offices, and administration offices for the Department of Aquaculture/Fisheries and the Aquaculture and Fisheries Center for Excellence. The Aquaculture/Fisheries Library (AFREL) is also housed in Woodard Hall, with significant paper volume holdings and rapidly increasing access to on-line resources (see Library Materials).

5. O.R. Holiday Applied Sciences Building

Opened in 2001 and adjacent to Woodard Hall, the Applied Sciences building is home to both Aquaculture and Agriculture facilities. Aquaculture laboratories for dissection and analytical exercises are available in addition to wet laboratories for fish experiments in aquaria and the Aquaculture/Fisheries Ichthyology Teaching Collection is housed on the first floor, and currently contains more than 5,000 specimens and more than 400 species.

6. UAPB Lonoke Farm

The UAPB Lonoke farm is an additional aquaculture resource located about 1 hour from campus. The farm is home to agricultural research projects, and has 13 ponds with nearly 200 acres of water. The ponds are leased to Arkansas Game & Fish Commission who manages the ponds and uses several for game fish production. Other ponds on the property are available for research projects.

7. Lonoke Diagnostics Laboratory

The Diagnostic Lab in Lonoke specializes in the diseases of baitfish, ornamental fishes, and water quality. The lab is in the Lonoke Agricultural Center Building on the south side of Highway 70, one mile east of downtown Lonoke. The building is located next to the Arkansas National Guard armory.

8. Lake Village Diagnostics Laboratory

This laboratory is located in the heart of the catfish industry in Southeast Arkansas. The lab is the second oldest in the UAPB Fish Disease Diagnostic system, and specializes in catfish disease and water quality as related to catfish production.

9. Newport Diagnostics Laboratory

The Newport Laboratory is located in North East Arkansas, an area with a diversity of culture species. It specializes in catfish disease and water quality. The lab is located on the campus of Arkansas State University-Newport.

Instructional Support and Technology

The Center currently has a large-scale Peer-to-Peer network with 125 networked computers using a fiber (ST/multi-mode) and copper based (Cat5e) 10Mbps backbone with a Full T-1 (1.544Mb) Internet connection. The network consists of underground fiber optic lines between four different facilities (Woodard Hall, S.J. Parker, 1890 Extension, and the Aquaculture Research Station), terminated with ST style connectors, connected to Fiber-to-Ethernet 10Mbps transceivers, feeding an installed base of 10BaseT network hubs. Most faculty and staff members are furnished with Dell or Gateway Pentium-4 (Windows XP) based computers running at 2Ghz or faster (Table 10). All faculty and staff members are furnished with their own personal printer in their offices (Table 11). Our graduate students are equipped with either Dell or Gateway

Pentium-4 (Windows XP) or Pentium-III (Windows 2000) based computers, with most students having a printer in their office.

Our web site hosting, email services and computer hardware purchase support are all provided off-site through written agreement with University of Arkansas Extension Services in Little Rock.

The teaching classroom/computer lab is equipped with 17 networked Pentium-4 (Windows XP) based computers, 16 for our students and one for the instructor's use. The instructors' podium is also wired with a network connection for laptop use and a shared network printer. Two separately controlled displays are provided for instructional use, a 60 inch (diagonal) plasma television and a ceiling mounted LCD video projector. These displays allow simultaneous viewing of programs (documents, spreadsheets, presentations, statistical analysis) running on any selected computer in the classroom, DVD and videocassette presentations. There is also a document camera on the instructor's podium, allowing non-digital based materials (pages from a book, documents, and small objects) to be displayed for all to see. Our undergraduate computer lab/study room is equipped with two Pentium-III (Windows 2000) and three Pentium-4 (Windows XP) based computers and a shared network printer. Our Research and Extension laboratories (Fish Health, Nutrition, Water Quality, and teaching labs) are equipped with an assortment of Pentium-4 (Windows XP) and Pentium-III (Windows 2000) networked computers. Pending available funding, all computers will be upgraded to Pentium-4 class hardware.

The Aquaculture/Fisheries satellite library resource room is equipped with four Pentium-4 (windows XP) based computers, one for the Librarian and three networked computer stations for student research, with a networked high-capacity printer and a flat-bed scanner available. The satellite library resource room is also equipped with a high-capacity photocopier.

The off-campus facility at Lonoke is run on a small Peer-to-Peer network shared with other University of Arkansas Division of Agriculture, Cooperative Extension Service personnel, using copper-based (Cat5e) 10/100Mbps backbone with Digital Subscriber Line (DSL) Internet connections. All Aquaculture/Fisheries Center personnel at these sites are furnished with Dell or Gateway Pentium-4 (Windows XP) based computers running at 2Ghz or faster and are furnished with their own personal printer in their offices.

The off-campus facility at Lake Village runs a small Peer-to-Peer network connected through an individually contracted digital subscriber line (DSL) Internet connection, using a copper-based (cat5e) 100 Mbps backbone. All Aquaculture/Fisheries Center personnel at this site are furnished with Dell or Gateway Pentium-4 (Windows XP) based computers running at 2 Ghz or faster and are furnished with their own personal printer in their offices. There are also wireless (WiFi) capabilities available for our visitors while they attend meetings and conferences in the conference room. Full-time audio/visual capabilities had been added at this location by installing a public address system, an LCD projector and a wall mounted projector screen.

The off-campus facility at Newport is provided Internet access through written agreement with Arkansas State University's campus computer network using fiber optics and copper-based (Cat5e) 100Mbps backbone for an Internet connection. There are no wireless (WiFi) capabilities in place at this time. The Extension specialist at this site is furnished with Dell and Gateway Pentium-4 (Windows XP) based computers running at 2Ghz or faster and is furnished with their a personal printer and scanner in the office.

Distance Education Laboratory, School of Agriculture, Fisheries, and Human Sciences

The Distance Learning Classroom and open computer lab of the School of Agriculture, Fisheries, and Human Sciences is located on the first floor of Woodard Hall, and features the following equipment and capabilities. The IP protocol based (H323 standard) system allowing distance learning classes or video conferencing with any other H323 standards based location in the world by way of the Internet. The equipment of this classroom is instructor coordinated by using the "Symposium" multimedia controller, running PC Presenter software. This hardware controller allows display of any selected digital computer display, video camera output, DVD video, or videotape source to the distant location and to the classroom's three wall mounted 42" plasma display screens. These sources include instructor's view and students' view video cameras, with the specialized sound system which allow visual and audio interaction between ALL classroom participants and distant participants of the conference. What is currently being displayed on any of the 21 networked Pentium-4 student computers, the instructor's desktop computer/laptop computer, the fixed document camera, the DVD player, or the videotape player may also be chosen for display on the wall mounted LCD monitors. To facilitate students' projects and work, a high capacity laser printer and a 42" wide format printer are available to print out their assigned work and projects. A full-time support technician is assigned to keep the classroom/lab fully operational and functional.

INTEL Computer Laboratory Technology Grant

This grant has vastly upgraded the computing capabilities of the Aquaculture/Fisheries program's teaching classroom and undergraduate computer lab. The 20 new Pentium-4 based computers, upgraded operating systems and current versions of nine different data analysis software programs will allow each of our students to become familiar with operation and use of a broad range of software analysis tools. The teaching classroom is set up in a (serverless) Peer-to-Peer network using classroom management software that allows viewing any selected classroom computer display, videotape, CD, DVD, or by using the video document camera viewing of a document, page of a book, or a small physical object – on either the wall mounted 60" Plasma screen monitor or the ceiling mounted LCD projector onto a projection screen. Ten Hewlett Packard personal data assistants (PDA's) will provide students with training on the capability of performing on-site data entry and retrieval through assigned class projects.

A faster T-1 communications line with fiber (ST/multi-mode) and copper based (Cat5e) 100Mbps backbone upgraded our Internet connection in 2008. The Center's network consists of existing underground fiber optic lines between three different facilities (Woodard Hall, S.J. Parker Agricultural Research Complex, S.J. Parker Extension Complex), and the newly added "fourth" fiber optic line to the Value-Added Product Development facility at the Aquaculture Research Station. All fiber optic lines connect to a Fiber-to-Ethernet 100Mbps transceivers, feeding an upgraded installed base of 10/100BaseT network switches. New fiber optic lines now connect the Value-Added Product Development (VAPD) Building to the Center's fiber backbone. The other buildings at the Aquaculture Research Station are connected with the VAPD building by a wireless (WiFi) bridge network allowing for full IP- Phone and Internet capability in all station work areas.

Program Budget:

Program Costs

The proposed program will be implemented via existing facilities, faculty and base funding. The Department of Aquaculture and Fisheries currently has the research facilities to accommodate Ph.D. students. Moreover, all the faculty and most of the courses are also in place. The five proposed new courses will be taught with existing teaching capacity in the department. This level of teaching capacity is available because the Department has worked towards developing a Ph.D. program for many years and has slowly added tenure-track faculty positions.

The Department has also obtained external grant funds to upgrade the computer laboratories in the department, the classroom with computer equipment and LCD projectors, and to expand library holdings in content areas relevant to the Ph.D. in aquaculture/fisheries.

Table 12 details the current budget of the Aquaculture/Fisheries Center. The overall budget for 2010 was $3.861 million. Of this, 67% is for salaries and fringe benefits of faculty, staff, and graduate students.

The additional costs needed for the program consist of the cost of additional assistantships for Ph.D. students. While some students are expected to be self-funded (through multilateral funding mechanisms and competitive fellowship grant programs available to students in this field), others will require assistantship support. Following consultation with the Dean of the Graduate School of the University of Arkansas at Fayetteville, we have budgeted assistantships for 10 Ph.D. students, $250,000. The additional assistantship costs required to initiate the program are expected to represent an increase of 6% of the Center’s total annual budget.

Sources of Funding

The primary source of funding to support the Ph.D. program is the existing base funding from USDA. This funding includes formula funds from the Evans-Allen line item appropriated for 1890 land-grant universities, state matching funds, and ARS pass-through funding. This is supplemented by external grant awards. The budget projects external grant awards of $200,000 to $300,000 a year (16% - 24% of the average amount of external grant awards for the Center over the past 5 years) in direct support of Ph.D. assistantships (Table 13).

Permanent on-going funding is available for 10 assistantships for Ph.D. students. At an annual cost of $25,000 per Ph.D. student, the total on-going cost of these assistantships is $250,000. There will be two major sources of these permanent, on-going funds: The Evans-Allen account of USDA-CSREES and funds used currently to support temporary instructors in the Departments of Biology, Chemistry, and Mathematics. The Evans-Allen funds are formula funds received by UAPB to carry out its land-grant mission as an 1890 land-grant university. Five assistantships, funded from Evans-Allen funds will be assigned to on-going projects planned as part of UAPB's overall Plan of Work with USDA. Five additional assistantships will be funded from accounts used to hire temporary instructors in biology, chemistry, and mathematics. These five Ph.D. students will be expected to teach lower level courses in the Departments of Biology, Chemistry, or Mathematical Sciences and Technology.

At least one proposal a year will be submitted from the Department of Aquaculture and Fisheries and the Center of Excellence in Aquaculture/Fisheries to seek funding explicitly for the Ph.D. program. This proposal will include funding for Ph.D. student assistantships. The first such proposal was approved in 2007 for $199,547 from the USDA Capacity-Building Grants Program. USDA staff who work with the Capacity-Building Grants Program have expressed a keen interest in the Ph.D. program, and we are confident that the probability of continued success in acquiring these funds is high.

Other possible sources of support and programs include the National Science Foundation that provides funding to develop teaching capacities for which UAPB will be eligible and the Multi-Cultural Scholars Program (USDA) that provides fellowships for Ph.D. students.

Table 14 lists new external grant funds received in 2010 ($1.395 million) for each faculty member in the Aquaculture/Fisheries Center. Research funding has flowed from 26 different sources in support of a wide variety of research topics over the last 5 years (Table 14). Moreover, the Center has averaged $1.13 million/year for the past 5 years. The success and stability of acquiring extramural funding indicates a strong capability to support students throughout their studies. Also, the wide variety of topics covered by extramurally-funded grants provide diverse opportunities for students to develop strong, comprehensive research skills with mentors active in a variety of research areas.

Enrollment and revenue projections

New student tuition and fees are expected to increase from $17,540 to $37,216 during the first three years of the program (Table 15). Anticipated enrollment is presented in Table 15. This program is not expected to yield a high enrollment. However, the enrollment levels projected are conservative, feasible, and adequate to meet state graduation standards for Ph.D. programs. With a conservative enrollment estimate of 10 Ph.D. students by year three, who will take from 3-4 years to complete the Ph.D. degree, a graduation rate of 2.5-3 Ph.D. students a year is projected.

Program Duplication (similar programs in Arkansas):

The proposed doctoral program at UAPB will be the only degree program in the state of Arkansas that provides focused and applied doctoral training for research scientists and future university educators in the disciplines of aquaculture and fisheries. The Aquaculture/Fisheries Center at UAPB is uniquely positioned to assume this role. At present UAPB provides the only undergraduate degree in Aquaculture and Fisheries in the state, has as its primary stakeholders aquaculture producers, aquaculture support industries, farm pond owners, natural resource managers (particularly state and federal agencies), and UAPB is the only state-supported institution of higher education in Arkansas that has the statewide responsibility for both research and extension in aquaculture and fisheries. UAPB campus facilities include an operating pond research station and a number of laboratories that provide unique and diverse research programs in fisheries and aquatic science. At present the department offers the widest array of graduate course work in aquaculture and fisheries science in the state.

<u>Other Ph.D. biology and environmental science programs within the state of Arkansas</u>

Four Arkansas universities currently offer Ph.D. programs in areas related to biology and environmental science: University of Arkansas (UA), University of Arkansas at Little Rock (UALR), University of Arkansas for Medical Sciences (UAMS), and Arkansas State University (ASU).

UAMS: The focus of the UAMS doctoral program is primarily to human health. As such it provides opportunities for supporting coursework in biological science but does not duplicate the research and training mission proposed by a UAPB Ph.D. program in Aquaculture and Fisheries.

UA: The University of Arkansas located in Fayetteville is one of the state's two land grant institutions and offers a doctoral program in Biological Science. The UA Department of Biology has 26 faculty and 3 faculty that maintain active research interests in natural fisheries. The UA Department of Biology also houses the USGS Fish & Wildlife Cooperative Research Unit that provides graduate-level training in natural fisheries and wildlife. UA also offers Ph.D. training in Animal Science that emphasizes forms of agriculture separate from aquaculture.

UALR: UALR has developed a doctoral program in applied science. The Department of Applied Science is an interdisciplinary program that supports applied research in a broad set of areas including Applied Biosciences. The emphasis of the Applied Bioscience Ph.D. Program is coordinated to interact with biotechnology industries within the state of Arkansas.

ASU: An interdisciplinary doctoral program in Environmental Science at ASU was approved by the Arkansas Higher Education Committee in 1997. This program integrates agricultural, engineering, ecological, political or economical issues surrounding natural resource degradation, management, and remediation. A number of faculty in the ASU Department of Biology are affiliated with the Environmental Science program and offer varied graduate course work to satisfy the program goal.

Institutional Program Productivity:

Assessment and Evaluation

Program Assessment

The Ph.D. program will be supported by a strong framework of internal and external assessment comprised of three categories:

1. Ph.D. Student/Candidate Assessment
2. Internal Program Assessment

3. External Program Assessment

1. Ph.D. Student/Candidate Assessment

Students will adhere to a specified set of timelines and milestones upon entering the Ph.D. in Aquaculture/Fisheries Program (Figure 3).

During the first semester after appointment, the students must form their advisory committee. The advisory committee should consist initially of at least five members including the advisor. Faculty from the Department of Aquaculture and Fisheries must compose a majority of the committee members and must have UAPB graduate faculty status. UAPB faculty from other departments must also have UAPB graduate faculty status to serve on advisory committees. Students are encouraged to seek professionals from outside of the department to serve on their advisory committee. A Memorandum of Agreement with the Graduate School of the University of Arkansas for Medical Sciences provides for UAMS doctoral faculty to also serve on dissertation committees of Ph.D. candidates in Aquaculture/Fisheries (See Appendix). These professionals are not required to have graduate faculty status.

A program of study must be finalized by the end of the first semester of graduate course work in a committee meeting. This meeting should be arranged by the student and attended by the advisor, all committee members, and the graduate coordinator and/or the department chair. Conference call arrangements should be made for committee members unable to attend the meeting. The advisory committee, the graduate coordinator, and the department chair must all sign programs of study, indicating their approval. The program of study should include a minimum of 42 credit hours. A student's committee may require further course work.

A cumulative grade point average of 3.0 or better on a 4-point scale must be maintained during the student's academic career. If a student's GPA falls below a 3.0 he/she is placed on academic probation during the following semester. If at the end of the probationary semester, the student's GPA is still below a 3.0, the student will be dismissed from the Ph.D. degree program. The dismissal may be appealed to the advisory committee, graduate coordinator and the department chair.

Students will prepare a dissertation concerning original research during their tenure in the Ph.D. degree program. A dissertation proposal should be presented and defended in a seminar prior to the initiation of dissertation research and must be completed and approved by all committee members within the first 200 days in the program. That implies that for a student entering the program in the spring, summer I, summer II, or fall semesters, the dissertation proposal must be completed before July 31, December 15, January 31, March 15, respectively. Failure to complete the dissertation proposal, (i.e., public presentation and defense of proposal, and submission of approved dissertation proposal by all committee members) by the end of the second semester after entering the program will result in termination of the assistantship. Upon completion of the dissertation proposal, proposal defense, and submission of the proposal with signatures of committee members, the assistantship will be resumed. Lost income will not be returned and the student is not eligible for employment in the department during this time period. Exceptions to assistantship loss are only granted due to extreme circumstances and must be approved by the department chair. The proposal must include an Introduction, Literature Review, Methods, and Citations section. The style of the dissertation proposal will follow the "manuscript preparation" guidelines for American Fisheries Society or World Aquaculture Society journals. The advisory committee, the graduate coordinator, and the department chair must sign the dissertation proposal. The original must be filed in the department office with the graduate coordinator.

Students must pass a preliminary examination prior to defense of their dissertation. The preliminary examination will test a student's overall competence and ability to think critically and synthesize information. The examination will include written and oral components provided by the advisory committee, and a standardized written component from the department. The student's graduate committee and a designated departmental committee will be responsible for constructing, administering, and grading each component of the examination, respectively. Students should meet with each committee member to determine the exam format and content in order to prepare properly.

The preliminary examination must be successfully completed no later than one year prior to the semester a student wishes to graduate. One dissenting vote (other than the major professor) is allowed for the student to pass their preliminary examination. Students who do not successfully complete the preliminary examination on their first attempt will be notified in writing by their advisor and may be required to conduct more coursework or independent study prior to attempting the exam a second time. Students who fail the preliminary examination twice will be dismissed from the program. Notification of successful completion of the preliminary examination must be made known to the department and to the registrar by the committee.

The dissertation will be presented in seminar format. The student's major professor and advisory committee must concur that the dissertation is ready for defense. Notice of the defense must be posted at least one week prior to the event. The student will give a 30-40 minute overview of his/her research and results followed by audience questions (total time 60 minutes). The student's advisor will serve as moderator of the seminar. Following the seminar, the student and committee will meet for the dissertation defense. Upon completion of the defense the student will be excused while the committee determines the outcome of the defense (pass/fail). One dissenting vote is allowed for the student to pass his/her dissertation defense. The student will be notified immediately following the defense of his/her success or failure and what changes must be made before the dissertation will be given final written approval by the committee. The committee chair will provide written notification of the defense outcome to the student and the graduate coordinator. If the student fails the dissertation defense, the student will be given the opportunity to defend a final time at least 30 days after the first defense. If the student fails the second defense, he/she is dismissed from the program.

<u>2. Internal Program Assessment</u>

There are four internal assessment strategies in place to ensure that the Ph.D. program provides students with the necessary tools to succeed:

A. Student Course Evaluations
B. Peer Course Reviews

C. Annual Report of Progress Towards the Degree
D. Exit Surveys
E. Former Student Surveys

A. Student Course Evaluations

Every student has the opportunity to evaluate the course instructor at the end of the semester of instruction. Student evaluations are anonymous and are conducted in the absence of the instructor. The evaluations allow students to provide additional comments as well as responses in the following areas regarding the instructor:

- Communication/English skills
- Appropriateness of quizzes, exams, and assignments
- Grade returns and explanation
- Encourages class dialogue
- Promptness in class attendance
- Preparedness for instruction
- Concern for student learning
- Is available to students
- Uses time wisely
- Overall rating of instructor

Student evaluations are provided to the Department Chair who discusses evaluations and ways to improve with individual faculty during their annual performance review.

B. Peer Course Reviews

A revolving peer review committee consisting of three departmental faculty is charged with providing independent reviews each time the course is offered. Reviews are distributed throughout the semester and the classroom visits are unannounced. The peer reviewer rates the instructor in the categories:

- Evidence of planning
- Teacher/pupil dialogue
- Clarity of expression
- Student enthusiasm
- Command of subject
- Teaching aids
- Promptness
- Explanations & demonstrations
- Courteousness
- Critical thinking

Peer reviews are provided to the Department Chair who discusses evaluations and ways to improve with individual faculty during his/her annual performance review.

C. Annual Report of Progress Towards the Degree

Ph.D. candidates will prepare and submit an annual report of progress made towards their degree. The report will summarize progress by objectives of their dissertation proposal. It will include meetings attended, papers presented, proposals submitted, manuscripts submitted, and publications.

D. Exit Surveys

Following completion of the dissertation defense and final editing, and prior to leaving the University, each new Ph.D. will be administered an exit survey to obtain feedback on the quality of the program. The primary data collected are as follows:

- Employment plans
- Additional courses needed by the program
- Ratings of learning environment
  - Faculty teaching
  - Class laboratory activities
  - Faculty availability outside of class
  - Staff availability
  - Faculty supervision
  - Research opportunities
  - Opportunities to attend scientific meetings
  - Professional networking opportunities
  - Graduate Coordinator performance
  - Departmental facilities
  - Overall quality of program
- Open ended questions
  - What we are doing well
  - What needs improvement
  - Other comments

Survey responses will be summarized periodically and presented to appropriate departmental committees for consideration of action (e.g., new course suggestions will be presented to the Curriculum Committee).

E. Former Student Surveys

The Department of Aquaculture and Fisheries conducts a survey of alumni about every five years to determine their status and to acquire feedback on the program. In particular, the survey focuses on the appropriateness of the graduate curriculum and the areas that need improvement. The data collected are summarized as follows:

- Current employment information
  - Position title

    - Salary
    - Primary responsibilities
- Importance of UAPB coursework to current career by individual course
- Courses not offered that would have been useful
- Ratings of learning environment
    - Faculty teaching
    - Class laboratory activities
    - Faculty availability outside of class
    - Staff availability
    - Faculty supervision
    - Research opportunities
    - Opportunities to attend scientific meetings
    - Professional networking opportunities
    - Graduate Coordinator performance
    - Departmental facilities
    - Overall quality of program
- Importance of UAPB degree in obtaining current position
- Open ended questions
    - What we are doing well
    - What needs improvement
    - Other comments

Survey responses will be summarized periodically and presented to appropriate departmental committees for consideration of action (e.g., new course suggestions will be presented to the Curriculum Committee).

3. External Program Assessment

Graduate programs at UAPB are governed by policies and procedures established by the UAPB Graduate Council. These policies include approval of new graduate coursework, new graduate programs, and graduate faculty status. For the Ph.D. degree in Aquaculture/Fisheries, criteria developed by the UAPB Graduate Council for granting Ph.D.-supervision status to Aquaculture/Fisheries faculty will be reviewed by the UAMS Graduate School. Graduate student grievance policy, academic honesty policies, and academic standards are available in the 2010-2011 Graduate Studies Handbook at UAPB. Policies and procedures related to research misconduct are found in the Handbook of the Office of Research and Sponsored programs at UAPB.

The program will be periodically reviewed by experts from outside the university to ensure that a system is in place to produce qualified Ph.D. graduates. The Department of Aquaculture and Fisheries, the School of Agriculture, Fisheries, and Human Science, and the University of Arkansas at Pine Bluff undergo frequent reviews at all levels. Most notable of these external evaluations are the following:

A. Advisory Council Review
B. Farm Bureau Review

C. External Peer Review
D. USDA CSREES Review
E. The Higher Learning Commission: North Central Association (NCA)

A. Advisory Council Review

The UAPB National Aquaculture/Fisheries Advisory Council, which is made up of stakeholders and peers of the Aquaculture/Fisheries Center, meets annually to review the Center's activities. Table 16 lists the membership and affiliation of the Advisory Council.

B. Farm Bureau Review

The Aquaculture Division of the Arkansas Farm Bureau reviews the research program of the UAPB Aquaculture/Fisheries Center about every 3 years. During this review, representatives of the Aquaculture Division (all fish farmers from throughout the state) convene at a meeting during which aquaculture researchers present an overview of the problems being addressed in their research programs and the results of their studies. While this forum is primarily a review process that also provides stakeholder input for the Center, research results are also distributed to industry leaders during these reviews.

C. External Peer Review

A Memorandum of Agreement with the Graduate School of the University of Arkansas for Medical Sciences provides for an external review of applications for UAPB graduate faculty status from the Department of Aquaculture and Fisheries and ongoing dialogue and review with the UAMS Dean of the Graduate School (See Appendix).

The USDA-NIFA requires that NIFA-funded programs undergo periodic reviews, as either external peer reviews or a USDA-NIFA review. The Aquaculture/Fisheries Center of Excellence conducted an external peer review in 1999.

D. USDA NIFA Review

The School of Agriculture, Fisheries, and Human Sciences can request an official USDA-NIFA review team to conduct a site visit to provide constructive opinions on research and extension programs. The most recent such review in 2006 stated that "The Department (of Aquaculture and Fisheries) is an outstanding unit with an excellent record of research that is pertinent and credible, as well as providing a rich academic program." "The undergraduate program is gaining credibility throughout the state and the graduate program is attracting quality candidates nationally and internationally. The faculty researchers and extension personnel have developed a nationally, and in some cases, an internationally recognized research program. It is having major positive impacts on the aquaculture industry and various other state and federal agencies that have not previously formed intra-state alliances."

E. Higher Learning Commission: NCA Accreditation

The University of Arkansas undergoes an institutional accreditation process periodically conducted by the Higher Learning Commission: NCA. The University prepares and submits a comprehensive Self-Study Report. Site visits provide evidence that UAPB satisfies criteria for continued accreditation and identifies areas where the institution can improve. Accreditation reviews are conducted on a campus-wide basis every 10 years. The previous review took place in 1996, followed by the November 2006 accreditation review. The University received continued accreditation.

Desegregation

UAPB has contributed substantially to the diversity and talent of the leadership of the United States Fish and Wildlife Service (USFWS) and other agencies. In addition, the UAPB strategic plan includes providing superior educational experience for minority students. This would be the only Ph.D. program in aquaculture/fisheries at a Historically Black College and University (HBCU) that is located in the major fish farming region of the country. The top aquaculture program officer in the research branch of USDA (ARS) has emphasized the need for Ph.D. graduates from UAPB. Lack of minority Ph.D. candidates for the Agricultural Research Service (USDA) and other positions is severe and long-standing.

Organizational Chart

Figure 4 presents an organizational chart for the School of Agriculture, Fisheries, and Human Sciences at the University of Arkansas at Pine Bluff. The Ph.D. Program in Aquaculture/Fisheries will be administered by the Department of Aquaculture and Fisheries. The Department of Aquaculture and Fisheries is one of three departments in the School of Agriculture, Fisheries, and Human Sciences. Courses taught and mentoring of Ph.D. students will be the responsibility of the faculty in the Department of Aquaculture and Fisheries. These faculty have appointments in the Aquaculture/Fisheries Center of Excellence, through which research and extension activities are conducted.

Institutional and Board of Trustees Approval of Proposed Program

The proposed program was approved through all committees and signed by the Chancellor of the University of Arkansas at Pine Bluff on May 11, 2007 (see approval tab). The University of Arkansas Board of Trustees approved the program on September 4, 2009 (see resolution in signatures tab).

References

Kohler, C. 2006. Wanted: highly skilled individuals to manage and conserve our fishery resources. Fisheries 3(1):4.

U.S. Department of the Interior. 2007. 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation. U.S. Fish and Wildlife Service and U.S. Department of Commerce, Washington, D.C.

Table 1. Employment Opportunities for Which Graduates with a Ph.D. Degree in Aquaculture/Fisheries Would be Expected to be Competitive.

Type	Position Title	Specific
University	Assistant Professor	Aquaculture
		Fisheries
		Fisheries Science
		Fisheries Management
		Fish Health
		Aquatic Science
		Biology
		Ecology
		Environmental Science
USGS	Assistant Coop Unit Leader	Fisheries
	Research Scientist	Fisheries
USDA-ARS	Research Scientist	Aquaculture
		Fish Nutrition
		Fish Health
		Water Quality
USDA-University Extension	Extension Specialist	Aquaculture
		Fisheries
		Natural Resources
		Water Quality
		Small Impoundments
USDA-FSIS	Program Managers	Aquaculture
	Program Analysts	Water Quality
	Seafood Inspectors	Fish Health
USDA - Forest Services	Research Biologist	Fisheries Science
USFWS	Research Biologist	Aquaculture
		Fisheries
NOAA	Research Scientist	Aquaculture
	Research Scientist	Population Dynamics
	Research Scientist	Fisheries
FDA-NCTR	Research Scientist	Aquaculture
		Water Quality
		Toxicology
State Agencies	Fisheries Biologist/Manager	Fisheries
		Fisheries Management
		Fisheries Science
Consulting Services	Biologist	Aquaculture
	Biologist	Fisheries

Table 2. Core and Related Areas of the Knowledge Base in Aquaculture/Fisheries Expected of Ph.D. Students

Content Area	Courses that Satisfy Requirement
Aquaculture	Advanced Aquaculture, Hatchery Science
Fisheries Management	Fisheries Management, Management of Small Impoundments
The Fish	Fish Physiology, Fish Genetics, Aquatic Animal Nutrition, Fish Health
The Fish and its Environment	Ecology of Fishes, Stream Ecology, Reservoir Fisheries and Ecology
The Water	Aquaculture Chemistry and Analysis, Water Quality Management
The Economy, Market, and Policy	Aquaculture Economics, Aquaculture Marketing, Quantitative Methods in Aquaculture and Fisheries, Program Evaluation and Survey Methods
Statistics/Measurement/Analysis	Statistics in Research, Univariate & Multivariate Models in Fisheries Science, Experimental Design & Analysis, Nonparametric Methods, Population Dynamics, Fisheries Modeling
Research Ethics[a]	Ethics[b], Scientific Communications and Ethics[b], Research Ethics[c]

[a]Required.
[b]Offered at UAMS.
[c]In development at UAPB, in cooperation with UAMS.

Table 3. Graduate Courses Currently Offered by the Department of Aquaculture and Fisheries

Course number	Course title	Credit hours	Instructor
GAQF 5310	Advanced Aquaculture	3	Peter Perschbacher
GAQF 5322	Aquaculture Economics	3	Carole Engle
GAQF 5323	Aquaculture Marketing	3	Madan Dey
GAQF 5336	Aquatic Animal Nutrition	3	Rebecca Lochmann
GAQF 5441	Aquatic Chemistry and Analysis	4	Yushun Chen
GAQF 5414	Ecology of Fishes	4	Steve Lochmann
GAQF 5220	Engineering and Construction of Aquaculture Facilities I	2	Nathan Stone
GAQF 5221	Engineering and Construction of Aquaculture Facilities II	2	Eric Park
GAQF 5407	Experimental Design and Analysis	4	Lin Xie
GAQF 5315	Extension Methodology	3	Richard Poling
GAQF 5430	Fish Health Protection	4	Andrew Goodwin
GAQF 5420	Fish Physiology	4	Alf Haukenes
GAQF 5325	Fish Population Dynamics	3	Michael Eggleton
GAQF 5371	Fisheries Management	3	Steve Lochmann
GAQF 5435	Management of Small Impoundments	4	Anita Kelly
GAQF 5208	Nonparametric Methods in Data Analysis	2	Lin Xie
GAQF 5310	Program Evaluation and Survey Methods	3	Madan Dey
GAQF 5324	Quantitative Methods in Fisheries and Aquaculture Economics	3	Madan Dey
GAQF 5300	Research Methods and Scientific Writing	3	Team taught
GAQF 5405	Statistics in Research	4	Lin Xie
GAQF 5445	Stream Ecology	4	Michael Eggleton
GAQF 5406	Univariate and Multivariate Models in Fisheries Science	4	Lin Xie
GAQF 5341	Water Quality Management	4	Yushun Chen
GAQF 5390-5391	Special Topics	3	Faculty
GAQF 5195-5196	Graduate Seminar	1	Faculty
GAQF 5198-5398	Graduate Research Problems	1-3	Faculty
GAQF 5129-5999	Research and Thesis	1-9	Faculty

Table 4. New Courses Proposed by Aquaculture and Fisheries[a]

Course Number	Course Title	Credit Hours	Instructor
GAQF 5326	Fisheries Modeling	3	Michael Eggleton
GAQF 5335	Reservoir Fisheries and Ecology	3	Team taught
GAQF 5340	Integrated Fish Hatchery Science	3	Alf Haukenes
GAQF 5345	Genetics Principles and Applications in Fisheries and Aquaculture	3	Alf Haukenes
GAQF 5314	Ecology of Caribbean Reef Fishes	3	Steve Lochmann Anita Kelly
GAQF 5v71-75; 5v81-85	Teaching/Extension Practicum	1-4	Faculty mentor

[a]The addition of these courses will not result in any teaching overloads.

Table 5. Graduate Courses Currently Offered by UAPB Departments Other than Aquaculture and Fisheries Relevant and Available to Ph.D. Students in Aquaculture/Fisheries.

Course number	Course name	Credit hours
GCHM 5311	Advanced Laboratory	3
GCHM 5312	Advanced Biochemistry	3
GCHM 5325	Advanced Chemistry	3
GCHM 5335	Nuclear Chemistry	3
GCHM 5340	Advanced Organic Chemistry	3
GCHM 5350	Chemical Separations	3

Table 6. Graduate Courses Identified by Aquaculture/Fisheries Faculty as Useful for Ph.D. Students in Aquaculture/Fisheries that are Available at Nearby Campuses.

Topic	**Course**	**Online**	**UALR**	**UAMS**	**UAM**	**UCA**
Fish Health	Parasitology					x
Fish Health	Immunology		x	x		x
Fish Health	Pharmacology			x		x
Fish Health	Pathogenic bacteriology		x			
Fish Health	Biochemistry		x	x		x
Aquatic Sciences/Ecology	Wildlife-habitat relationships				x	
Aquatic Sciences/Ecology	Limnology		x (not offered recently)			
Basic Science Electives	Endocrinology			x		x
Basic Science Electives	Environmental physiology					x (Phys ecol)
Basic Science Electives	Cell biology/physiology		x	x		
Basic Science Electives	Histology					x
Basic Science Electives	Comparative physiology		x	x		x (Animal Phys)
Basic Science Electives	Toxicology			x		
Basic Science Electives	Molecular biology/genetics		x		x	x (Molecular)
Basic Science Electives	Biochemistry		x	x		x
Basic Science Electives	Neurobiology		x			x
Basic Science Electives	Microbiology			x		x
Basic Science Electives	Vertebrate physiology (Comparative phys)		x	x		x
Basic Science Electives	Advanced cell biology		x	x		
Other	GIS		x		x	x
Other	Soils				x (forest)	
Other	Advanced instrumentation		x			x

	//microscopy		(microscopy)		(microscopy)
Social Science	Human dimensions in natural resources			x	
Social Science	Introduction to econometrics		x		
Social Science	Econometrics		x		
Social Science	Microeconomics		x		
Social Science	Macroeconomics		x		
Social Science	Finance		x		x
Social Science	International trade	x			
Social Science	Natural resource economics	x	x	x	
Social Science	Marketing		x		x

Table 7. Awards Received by Faculty in the UAPB Aquaculture/Fisheries Center, 2001-2010.

Faculty name	Name of Award	Source of Award	Year
Michael Eggleton	Tied for Second Best Published Paper in 2009	SEAFWA Proceedings	2010
David Heikes	Received the regional "Excellence in Extension Award"	National Association of State Universities and Land-Grant Colleges	2010
Rebecca Lochmann	Service Award for Research in Catfish Nutrition	Catfish Farmers of Arkansas	2010
Peter Perschbacher	Top Ten Cited Papers 2006-2010	Asian Fisheries Science	2010
Thomforde	President's Volunteer Service Award	President's Council on Service and Civic Participation, Corporation for National and Community Service	2010
Michael Eggleton	Teaching Award of Merit	Gamma Sigma Delta	2009
Andrew Goodwin	2009 North American Colleges and Teachers of Agriculture (NACTA) Award for Teaching Excellence	School of Agriculture Fisheries and Human Sciences	2009
Carole R Engle	McCraren Award for exceptional service to the Aquaculture Industry	National Aquaculture Association	2008
David Heikes	Outstanding Service Award	Catfish Farmers of Arkansas	2008
Wes Neal	Best Professional Presentation	Joint Annual Meeting Arkansas/Mississippi Chapters – AFS	2008
Nathan Stone	Excellence in Extension Award of Merit	Gamma Sigma Delta	2008
Nathan Stone	1890 Regional Excellence in Extension Award	NASULGC	2008
Peter Perschbacher	Top Ten Cited Papers for 2006-2008	Asian Fisheries Science	2008
Andrew Goodwin	McCraren Award for "Outstanding contribution in promoting the growth of aquaculture"	NAA	2007
	Faculty Excellence Award of Merit	Gamma Sigma Delta	2007
	Certificate of Appreciation	AFS-FHS	2007
Rebecca Lochmann	Teaching Award of Merit	Gamma Sigma Delta	2007
Nathan Stone	Excellence in Extension Award of Merit	Gamma Sigma Delta	2007

Madan Dey	Outstanding Scientist Award Nomination	CGIAR	2007
Andrew Goodwin	Faculty Excellence Award of Merit	Gamma Sigma Delta	2006
Rebecca Lochmann	Teaching Award of Merit	Gamma Sigma Delta	2006
Wes Neal	Honorable mention for the Weithman Award	American Fisheries Society	2006
Brent Southworth, Carole Engle, Nathan Stone	1st place award for scientist papers in Small Farm and Rural Development category. 14th Biennial Research Symposium	1890 AEA/ARD	2006
Entire Center	1890 System-Wide Integration Award	1890 AEA/ARD	2005
Jo Sadler, Andrew Goodwin	1st place paper in Emerging Issues category	1890 AEA/ARD	2005
Carole Engle, Kwamena Quagrainie, David Heikes, Steeve Pomerleau	1st place paper in Community and Economic Development category	1890 ARA/ARD	2005
Andrew Goodwin	Service Award in Recognition of Outstanding Service	Catfish Farmers of Arkansas	2005
Steve Lochmann	Best Professional paper	Arkansas Chapter, American Fisheries Society	2005
Nathan Stone	Dedicated Service	Arkansas Bait and Ornamental Fish Growers Association	2005
Carole Engle	McCraren Award	National Aquaculture Association	2004
Chris Racey, Steve Lochmann, Amy Fenech	Best Professional Paper	Southeastern Association of Fish and Wildlife	2005
Carole Engle	Recognized at Women's Day Luncheon	UAPB	2004
Carole Engle	USDA Certificate of Appreciation for service on Aquaculture Effluents Task Force	USDA	2004
Andrew Goodwin, Matt McEntire	Best Paper of the Year, Journal of Aquatic Animal Health	American Fisheries Society	2004
Nathan Stone	USDA Certificate of Appreciation for service on Aquaculture Effluents Task Force	USDA	2004
Carole Engle	Outstanding Service to the Catfish Industry	Catfish Farmers of	2003

		Arkansas	
Carole Engle	Researcher of the Year	Catfish Farmers of America	2003
David Heikes	Outstanding Service to the Catfish Industry	Catfish Farmers of Arkansas	2003
Carole Engle	Harvey McGeorge Distinguished Award of Service to Agriculture	Rotary Club	2002
Carole Engle	Best Paper of the Year, North American Journal of Aquaculture	American Fisheries Society	2002
Andrew Goodwin	Outstanding Service to the Catfish Industry	Catfish Farmers of Arkansas	2001

Table 8. Recent Awards Received by Students in the Aquaculture/Fisheries Center

Student name	Name of award	Title of presentation/paper	Name of meeting/journal	Year
Abed Rabbani	1st Place Award in graduate level		23rd Annual Student/Faculty Research Forum	2010
Ganesh Thapa	William Willingham Award – overall graduate presentation		23rd Annual Student/Faculty Research Forum	2010
Abed Rabbani	2010 Travel Award		International Association of Aquaculture Economics and Management	2010
Ganesh Thapa	2010 Travel Award		International Association of Aquaculture Economics and Management	2010
Pratheesh Omana	Honorable Mention – dissertation and thesis awards		International Association of Aquaculture Economics and Management	2010
Abed Rabbani	2nd Place Award Outstanding Achievement in Human Science	Importation of catfish into USA: trends and determinants	15th Biennial Research Symposium of the Association of Research Directors	2009
Ganesh Thapa	1st Place Award – Outstanding Achievement in Human Sciences	The Asian ethnic fish market in the Northeastern region of US: Consumer preferences and market growth and structure	15th Biennial Research Symposium of the Association of Research Directors	2009
Calvin Fisher	1st Place Award – Undergraduate Level	Propagation and rearing methods for yellowcheek darter *Etheostoma moorei*	22nd Annual Student/Faculty Research Forum	2009
Patricia Eklund	William M. Willingham Award – Overall Best Presentation	Management of aquatic weeds in Arkansas: species and current control techniques	22nd Annual Student/Faculty Research Forum	2009
Pratheesh O. Sudhakaran	1st Place – Graduate	Testing feed response methods of inventory	22nd Annual Student/Faculty	2009

	Level	estimation for channel catfish (*Ictalurus punctatus*) production	Research Form	
Carlos Prieto	Gamma Sigma Delta Academic Achievement Award of Merit			2009
Candace Rodgers	Gamma Sigma Delta Academic Achievement Award of Merit			2009
Patricia Eklund	Gamma Sigma Delta Academic Achievement Award of Merit			2009
Brett Timmons	AFC Outstanding Member 2009-2010			2009
Ganesh Thapa	1st Place – Best Presentation Award – Graduate Student	The Asian ethnic fish market in the northeastern region of U.S.: consumer preference, and market growth and market structure	Association of Research Directors, Inc. – 15th Biennial Research Symposium	2009
Abed Rabbani	2nd Place – Best Presentation Award – Graduate Student	Importation of catfish into USA: trends and determinants	Association of Research Directors, Inc. – 15th Biennial Research Symposium	2009
Pratheesh Sudhakaran	1st Place Award – Graduate Level	Testing feed response methods of inventory estimation for channel catfish *Ictalurus punctatus*	22nd Annual Student/Faculty Research Forum	2009
Calvin Fisher	1st Place Award – Undergraduate Level	Propagation and rearing methods for yellowcheek darter *Etheostoma moorei*	22nd Annual Student/Faculty Research Forum	2009
Patricia Eklund	William M. Willingham Award – Overall Best Presentation	Management of aquatic weeds in Arkansas: species and current control techniques	22nd Annual Student/Faculty Research Forum	2009

Patty Eklund	1st Place Award – Graduate Level	Aquatic Nuisance Plant Species in Arkansas	Annual UAPB Student Research Forum	2008
Patty Eklund	1st Place – Oral Presentation		U.S. Aquaculture Society Annual Meeting	2008
Ashlee Paver	Best Graduate Student Paper	Effect of fry stocking density on the production of rosy red fathead minnows in pools	Annual UAPB Research Forum	2008
Adam Nanninga	Outstanding Member		Arkansas Chapter of the American Fisheries Society	2008
Adam Nanninga	1st Place		Student Quiz Bowl – Aquaculture America	2008
Lael Will	Best Student Presentation		Joint Meeting of the Arkansas and Mississippi Chapters of the American Fisheries Society	2008
Dontay Williams	Best Undergraduate Paper	Does selective breeding cause an increase resistance to bacteria cold water disease in rainbow trout (*Onchorhynchus mykiss*)?	Annual UAPB Student Research Forum	2008
Ben Batten	Graduate Academic Achievement Award of Merit		Gamma Sigma Delta	2007
Paul Port	Graduate Academic Achievement Award of Merit		Gamma Sigma Delta	2007
Baby Suja Aarattuthodiyil	Graduate Academic Achievement Award of Merit		Gamma Sigma Delta	2007
Krystal Pree	Undergraduate Academic Achievement Award of Merit		Gamma Sigma Delta	2007
Steve Mondragon	Undergraduate Academic Achievement Award		Gamma Sigma Delta	2007

	of Merit			
Veronica Bullock	Undergraduate Academic Achievement Award of Merit		Gamma Sigma Delta	2007
Tom Lang	Stephen-Weithman-Best Paper in the Field of Socioeconomics	Implications of reduced stocking frequencies on fishing quality in the Arkansas urban fishing program	American Fisheries Society's 137th Annual Meeting	2007
	Runner-up Best Student Presentation	Does stocking frequency matter in Arkansas family and community programs	SDAFS	2007
Nicholas Phelps	1st place	Validation of a quantitative PCR diagnostic method for the microsporidian *Ovipleistophora ovariae* in cyprinid fishes and assessment of vertical transmission	6th Annual American Fisheries Society Student Colloquium	2006
Marcella Melandri	Outstanding Member		UAPB American Fisheries Society Student Subunit	2006
Nate Harris	Best Graduate Student Paper	Growth and condition indices for a native Puerto Rico fish, bigmouth sleeper *Gobiomorus dormitor*	American Fisheries Society Student Sub-Unit	2006
Leonardo Matthews	William M. Willingham Best Overall Undergraduate Student Presentation	Fourier analysis of otolith shape to discrimination spotted and largemouth bass in the Arkansas River	19th Annual UAPB Student/Faculty Research Forum	2006
Ganesh Kumar	William M. Willingham Best Overall Graduate Student Presentation	Household preferences and consumption patterns for farm-raised catfish in the U.S.	19th Annual UAPB Student/Faculty Research Forum	2006
Marcella Melandri	Best Graduate Student Presentation (tied)	Effects of temperature on the growth of golden shiners	19th Annual UAPB Student/Faculty Research Forum	2006
Daryl Weldon	Best Graduate	Effects of dietary vitamin C concentration on	19th Annual UAPB	2006

	Student Presentation (tied)	growth and health of largemouth bass *Micropterus salmoides*	Student/Faculty Research Forum	
Brent Southworth w/ C. Engle	Best Graduate Student Paper	The effect of multiple-batch channel catfish stocking density and feeding rate on water quality, production characteristics, and costs	18th Annual UAPB Student/Faculty Research Forum	2005
Ignacio Masson w/ N. Stone	Best Graduate Student Paper	New hatchery methods for fathead minnows	Annual Meeting of the Arkansas Chapter of the American Fisheries Society	2005
Ignacio Masson w/ N. Stone	1st Place Poster Presentation	Evaluation of fathead minnow (*Pimephales promelas*) spawning substrates and egg removal with sodium sulfite	Aquaculture America 2005, Annual Meeting of the U.S. Aquaculture Society	2005
R. Lochmann, S. Rawles, B. Gopinath, R. Chen	Certificate of Achievement	Effect of different lipid supplements in practical diets on performance of channel catfish and muscle fatty acid composition	Rural Life Conference, UAPB	2005
Ben Lubinski w/ J. Jackson and M. Eggleton	1st Place, Graduate Student Paper Award	Characterization of floodplain lake fish assemblages in the lower White River, Arkansas	Southern Division of America Fisheries Society's Annual Meeting	2004
Liz Heitman w/ S. Lochmann	2nd Place, Graduate Student Paper Award	An evaluation of supplemental stocking of largemouth bass in pools of the Arkansas River	Annual Meeting, Southern Division, American Fisheries Society	2004
Sathyanand Kumaran w/R. Lochmann	Best Graduate Student Paper	Effect of dietary lipid on egg production and fry quality of fathead minnows (*Pimephales promelas*)	18th Annual UAPB Student/Faculty Research Forum	2004
Christopher Green w/ S. Lochmann	Best Graduate Student Paper	Fluctuating asymmetry and condition in golden shiner and channel catfish reared in sublethal concentrations of isopropyl methylphosphonic acid	Annual Meeting of the Arkansas Chapter of the American Fisheries Society	2004
Kraig Ruebush w/ C. Engle and C. Leyva	1st Place, Poster Presentation	The effect of protein level on catfish (*Ictalurus punctatus*) growth with alternate day feeding	World Aquaculture 2004	2004
Regina Edziye w/ P. Perschbacher	Best Abstract Award	Mesocosm studies on the effect of propanil on pond aquaculture	World Aquaculture 2004	2004
Chris Green w/ S. Lochmann	Best Student Platform Presentation	Acute toxicity of isopropyl methylphosphonic acid, a breakdown product of sarin, to early life	South Central Region of the Society of Toxicology	2003

		history stages of golden shiner and channel catfish	Annual Meeting	
Chris Green w/ S. Lochmann	Best Student Paper Award	Acute toxicity of isopropyl methylphosphonic acid, a breakdown product of sarin, to early life history stages of golden shiner and channel catfish	Arkansas/Tennessee State American Fisheries Society annual Meeting	2003
Ben Lubinski	AFS Skinner Award	Education Section	Annual Meeting of the American Fisheries Society	2003
Annette Williams	AFS Skinner Award	Education Section	Annual Meeting of the American Fisheries Society	2003
Matthew McIntyre w/L.R. Iwanowicz and A.G. Goodwin	2003 Best Paper Award	Molecular, physical and clinical evidence that golden shiner virus (GSV) and grass carp reovirus (GCR) are variations of the same virus	Journal of Aquatic Animal Health	2003
Emmanuel Frimpong	Landry Award	Hybrid Striped Bass Growers Association	Aquaculture America	2002
Sheeno Thyparambil w/ R. Lochmann, and B. Bjerkeng	Best Graduate Student Paper	Astaxanthin utilization by sunshine bass-a normal phase high-performance liquid chromatography and chromometric analysis	Annual UAPB Student/Faculty Research Forum	2002
Dan Troop w/ J. Fernández, and R. Lochmann	Best Undergraduate Student Paper	Apparent nutrient and energy digestibility of feed ingredients for goldfish (Carassius	Annual UAPB Student/Faculty Research Forum	2002
Kelly Winningham w/A.Goodwin	Best Graduate Student Paper	Toxicity of aerially applied pesticides to fish and shrimp: screening at the maximum field dose	Annual UAPB Student/Faculty Research Forum	2002
Chao Mwatela	Exemplary Female Student Award	Women’s Day	UAPB	2002

Table 9. Faculty in Aquaculture/Fisheries, University of Arkansas at Pine Bluff

Name	Degree	Institution	Specialty Area	Year Degree Completed
Madan Dey	Ph.D.	U. of the Philippines	Aquaculture Marketing	1988
	B.S.	Bangladesh Ag.U.	Agricultural Economics	1982
Michael A. Eggleton	Ph.D.	Mississippi State University	Fisheries	2001
	M.S.	Tennessee Technological Univ	Fisheries	1989
	B.S.	West Virginia State Univ.	Biology	1986
Carole R. Engle	Ph.D.	Auburn University	Aqua Economics	1981
	M.S.	Auburn University	Aqua Economics	1978
	B.S.	Friends World College	Biology/Rural Dev	1975
Andrew Goodwin	Ph.D.	Auburn University	Fish Pathology	1993
	M.S.	Auburn University	Fish Pathology	1990
	B.S.	University of Toledo	Biology	1983
Alf Haukenes	Ph.D.	University of South Dakota	Biological Sciences	2001
	M.S.	University of Idaho	Fisheries Resources	1995
	B.S.	University of Wisconsin-River Falls	Biology	1985
Anita Kelly	Ph.D.	Southern Illinois University	Zoology	1995
	M.S.	Southern Illinois University	Zoology	1990
	B.S.	University of Iowa	Biology	1987
Rebecca Lochmann	Ph.D.	Texas A & M University	Wildlife & Fish Sci.	1992
	M.S.	Florida Institute of Technology	Marine Biology	1988
	B.S.	Louisiana State University	Zoology	1981
Steve L. Lochmann	Ph.D.	Texas A & M University	Oceanography	1990
	M.S.	Florida Institute of Technology	Biological Sciences	1986
	B.S.	Valparaiso University	Biology/Chemistry	1982
Peter Perschbacher	Ph.D.	Texas A & M University	Fisheries Biology	1985
	M.S.	Auburn University	Fisheries Biology	1973

	B.S.	University of Michigan	Fisheries Biology	1968
David Heikes	M.S.	Louisiana State University	Fisheries Aquaculture	1991
	B.S.	Long Island University	Biology	1989
Larry Dorman	Addtl Grad Work	Mississippi State University		1984
	M.S.	Arkansas State University	Biological Sciences	1981
	B.S.	Univ. of Arkansas – Monticello	Wildlife/Fish Sci.	1977
George Selden	M.S.	Purdue University	Aquaculture	2000
	MAT	Indiana University		1995
	B. S.	Indiana University	Biology	1985
Nathan Stone	Ph.D.	Auburn University	Aquaculture	1988
	M.S.	Auburn University	Aquaculture	1981
	B.S.	Cornell University	Biology	1974
Hugh Thomforde	Ph.D.	Auburn University	Fisheries Mgmt	1990
	M.S.	University of the Philippines	Aquaculture	1987
	B.S.	Earlham College	Geology & Fine Arts	1979
Lin Xie	Ph.D. candidate	Kansas State University	Statistics	
	M.S.	University of Arkansas	Statistics (Biometry)	2003
	M.S.	University of Arkansas	Food Science	2001
	B.E.	Qingdao Institute of Chemical Technology	Chemical Engineering	1988
Yushun Chen	Ph.D.	West Virginia University	Environmental Engineering and Science	2009
	M.S.	Chinese Academy of Sciences	Aquatic Ecology	2006
	B.S.	Hunan Agricultural University	Aquaculture	2003
Small Impoundments	Ph.D.	Vacant		

Table 10. Technology in Aquaculture/Fisheries Center Classrooms and Computer Labs

Classroom/Computer Lab	Computers	Printers	Projectors
Woodard Hall – Rm 257 (Classroom/Computer Lab)	17 Pentium-IV's + Laptop Connection	Laser Printer	Boxlight LCD Ceiling Mounted 60" Plasma television
Woodard Hall – Rm204 (Aquaculture/Fisheries Research and Education Library)	4 Pentium-IV's 1 Pentium-III's	Laser Printer/Scanner/Copier Laser Printer	None
Woodard Hall – Rm 256 (Undergraduate Computer Lab)	3 Pentium-IV's 2 Pentium-III's	Laser Printer	None
Applied Sciences – Rm 105a (Teaching – Wet Lab)	None + Laptop Connection	None	Boxlight LCD Ceiling Mounted
Applied Sciences – Rm 105c (Teaching – Dry Lab)	1 Pentium – IV	None	Boxlight LCD Ceiling Mounted

Table 11. Aquaculture/Fisheries Center Faculty Computer Resources

Faculty Name	Brand	Processor	Memory	Hard Drive	Display
C. Engle	Dell laptop/docking	I5-520M, 2.4 Ghz	1Gb.	80Gb	24" LCD
M. Eggleton	Gateway	Pentium-4, 1.5Ghz	1Gb.	40Gb x2	18" LCD
M. Eggleton	Gateway laptop	Pentium-4, 2.0 Ghz	512Mb.	40Gb	14"LCD
A. Goodwin	Gateway	Pentium-4, 2.2Ghz	1Gb.	120Gb	19" LCD x2
A. Goodwin	Dell Laptop	Intel Duo-T2300, 1.66Ghz	1Gb.	80Gb	14"w LCD
A. Haukenes	Dell	Pentium-4, 2.8Ghz	1Gb.	80Gb	19" LCD
A. Haukenes	Gateway Laptop	Celeron-1.8Ghz	512Mb.	30Gb	15" LCD
R. Lochmann	Dell	Pentium-4, 2.6Ghz	1Gb.	40Gb	19" CRT
R. Lochmann	Dell Laptop	Pentium-4M, 715 (1.5Ghz)	512Mb.	40Gb	15" LCD
S. Lochmann	Dell	Pentium-4, 2.8Ghz	512Mb.	120Gb	17" LCD x2
S. Lochmann	Gateway Laptop	Intel Duo-T2300, 1.66Ghz	1Gb.	80Gb	15"w LCD
P. Perschbacher	Gateway	Pentium-4, 2.8Ghz	1Gb.	80Gb	17" LCD
P. Perschbacher	Toshiba Laptop	Pentium-4, 1.6Ghz	256Mb.	40Gb	15" LCD
L. Dorman	Gateway	Pentium-4, 2.4Ghz	512Mb.	60Gb	17" CRT
L. Dorman	Gateway Laptop	Celeron-2.4Ghz	512Mb.	20Gb	15" LCD
B. Duke	Gateway	Pentium-III, 933Mhz	128Mb.	40Gb	17" CRT
B. Duke	Dell Laptop	Pentium-4M, 740 (1.73Ghz)	512Mb.	40Gb	15" LCD
D. Heikes	Gateway	Pentium-4, 2.4Ghz	1Gb.	120Gb	19" CRT
D. Heikes	Dell Laptop	Pentium-4, 2.5Ghz	1Gb.	60Gb	15" LCD
G. Selden	Dell	Pentiun-4, 3.0Ghz	1Gb.	80Gb	19" CRT
G. Selden	Dell Laptop	Intel Duo – T8100, (2.10 Ghz)	2Gb	80Gb	15" LCD
N. Stone	Dell	Pentium-4, 3.0Ghz	1Gb.	250Gb	22" CRT
N. Stone	Dell Laptop	Pentium-4M, 740 (1.73Ghz)	1Gb.	80Gb	15" LCD
	Dell Laptop	Pentium-4M, 740 (1.73Ghz)	1Gb.	40Gb	15" LCD
H. Thomforde	Dell Laptop	Pentium-4M, 715 (1.5Ghz)	512Mb.	40Gb	15"LCD
	Dell	Pentium-4,2.2Ghz	512Mb	404b	19"LCD
L. Xie	Dell	Intel Quad-Q9550, 2.83 Ghz	8Gb	500Gb	24"LCD
	Dell Laptop	Intel Duo-T9800	8Gb	250Gb	15"LCD

		(2.93Ghz)			
M. Dey	Dell	Intel Core 2-QEuad, Q9400-2.66Ghz	8Gb	250Gb	19” LCD x2
	Sony Laptop	Pentium-4m, 735 (1.7 Ghz)	512 Mb	80 Gb	13” LCD
A. Kelly	Gateway	Intel Duo-E4300 2.2 Ghz	4 Gb	160Gb	19” LCD
	Dell Laptop	Pentium-m 1.6 Ghz	512 Mb	60 Gb	15” LCD

Table 12. Resource Requirements.

Item	Year	
	2010	2011
Current Budget for Aquaculture/Fisheries		
Staffing		
Administrative/Professional	446,210	455,134
Full-time Faculty	1,227,970	1,252,529
Part-time Faculty		
Graduate Assistantships	325,425	331,933
Clerical	78,915	80,494
Total Salaries	2,078,520	2,120,090
Fringe Benefits[a]	519,630	530,023
Total Salaries and Fringe Benefits	2,598,150	2,650,113
Equipment and Instructional Materials	331,500	338,130
Library	229,500	234,090
Other Support Services		
Supplies/Printing	533,034	543,694
Travel	115,666	117,979
Distance Technology		0
Other Services	53,244	54,309
Total, Current Aquaculture/Fisheries Budget	3,861,094	3,938,315
Additional Resources Required for Ph.D. Program		
Staffing		
Administrative/Professional	0	0
Full-time Faculty	0	0
Part-time Faculty	0	0
Graduate Assistantships	$245,098	$245,098
Clerical	0	0
Total Salaries	$245,098	$245,098
Fringe Benefits[a]	$4,902	$4,902
Total Salaries and Fringe Benefits	$250,000	$250,000
Equipment and Instructional Materials	0	0
Library	0	0
Other Support Services		
Supplies/Printing	0	0
Travel	0	0
Distance Technology	0	0
Other Services	0	0
Total Additional Resources Required	$250,000	$250,000

[a]Fringe Benefits = (25% of full-time salaries) + (10% of graduate student stipends).

Table 13. Planned Funding Sources

Item	Year		
	2011	2012	2013
New Student Tuition & Fees	$17,540	28,906	37,216
New State General Revenue	0	0	0
Redistribution of State General Revenue[a]	0	0	0
Temporary Instructors	$125,000	$125,000	$125,000
Evans-Allen Funding	$125,000	$125,000	$125,000
External Grants/Contracts	$300,000	$300,000	$300,000
Other Funding Sources – Title III	$237,193	$237,193	$237,193
TOTAL	$804,733	$816,099	$824,409

[a]UAPB has committed to providing five new Ph.D. assistantships each year. Values include assistantship stipends and fringe benefits (10%).

Table 14. 2010 Extramural Grant Funding for Aquaculture/Fisheries Center Scientists.

Scientist	Title of Grant	Amount Funded	Source of Funding
New Grants Approved in 2010			
Chen, Y.	Development of a decision-support tool to assess the risk of habitat degradation following watershed land use changes	$39,655	USDA-EPA
Chen, Y.	Managing major water quality problems in Arkansas baitfish farms	$11,000	AFC
Lochmann, R.	Effect of diets supplemented with CLA-enriched soybean oil, standard soybean oil, or marine fish oil on growth, health, feed conversion, survival, body composition, and shelf life on channel catfish	$9,000	Arkansas Soybean Promotion Board
Lochmann, R. and T. Sink	The effects of dietary soybean lecithin on channel catfish growth, innate immune response, lipid biochemical indices, and value of fillets for human health	$20,000	Arkansas Soybean Promotion Board
Lochmann, R., C. Engle, and D. Heikes	Feed performance testing and verification through an industry – University partnership – continuation (year 2)	$34,576	Arkansas Soybean Production Board
Engle, C.R.	Costs of managing aquatic invasive plants in the southern U.S.	$19,156	USFWS
Hart, A.E. Goodwin, and N. Stone	Aquaculture education part III	$191,350	United Soybean Board
Heikes, D. and N. Stone	Development of improved methods for stocking of sunshine bass fry	$72,340	USDA ARS Specific Cooperative Agreement
Chen, Y. and C. Engle	Modeling linkages between oxygen dynamics, catfish production, and economic outcomes in commercial catfish ponds with varying aeration levels	$20,000	USDA/ARS
Dey, M.M., C. Engle and C. Boyd	Evaluation of impacts of potential cap and trade carbon emission policies on catfish, baitfish, and crawfish farming	$120,000	SRAC
Dey, M.M., C. Engle, W.R. McClain and R.P. Romaire	Identifying determinants for development of live market grading standards for crawfish	$50,000	SRAC
Engle, C.	Target motad risk modeling to evaluate economic and risk effects of emerging technologies to improve survival of hybrid striped bass	$18,386	USDA/ARS

	production		
Goodwin, A.E. and A. Mitchell	qPCR: removing the limitations	$68,827	USDA/ARS
Haukenes, A. and A. Fuller	Determination of cross protective benefits associated with ‘heat hardening’ of hybrid striped bass and channel catfish fry	$56,624	USDA/ARS
Heikes, D. and N. Stone	Improving survival of hybrid striped bass fry: development of improved methods for stocking of sunshine bass fry	$72,340	USDA/ARS
Kelly, A. and A. Mitchell	Increasing growth rates of sunshine bass through triploid induction	$32,652	USDA/ARS
Kelly, A., D. Heikes and A. Mitchell	Controlling predacious copepods for pond water re-use for the production of hybrid striped bass fry	$50,397	USDA/ARS
Kelly, A., D. Heikes and H. Thomforde	Grading and sorting warmwater fish	$1,000	Southern Regional Aquaculture Center
Kelly, A.M. and D. Heikes	Improving off-flavor management	$13,898	Arkansas Catfish Promotion Board
Lochmann, R. and S. Rawles	The effects of lipid and a prebiotic on growth performance, immune responses, and thermal index in sunshine bass and channel catfish	$103,732	USDA/ARS
Lochmann, R.	Sorghum distillers dried grains as an alternative protein source in diets of channel catfish	$8,000	Arkansas Catfish Promotion Board
Lochmann, R.	Biochemical and genetic techniques to advance research in lipid metabolism and nutrition of channel catfish and largemouth bass	$281,630	USDA/Capacity Building Grant
Lochmann, S.	Optimizing propogation methods of larval yellowcheek darter etheostoma moorei at the Greers Ferry National Fish Hatchery	$2,500	US Fish and Wildlife – Ecological Services
Lochmann, S.	Techniques for culturing alligator gar	$30,000	USDA Evans-Allen
Eggleton, M.	Assessment of length-limit regulations, stock relationships with hydrology, and stock structure of Arkansas River largemouth bass populations	$68,000	Arkansas Game and Fish Commission
	Total Approved Funding 2010	**$1,395,063**	

Table 15. Extramural Funding, Aquaculture and Fisheries, 2001 to 2009.

Scientist	Title of Grant	Amount Funded	Source of Funding
2009			
S. Pomerleau N. Stone	Freshwater aquaculture community of practice	$60,000	USDA/eXtension
A. Lochmann A. Haukenes J. Ludwig A. Fuller	Improving reproductive efficiency of cultured finfish	$96,392	USDA-SRAC
R. Lochmann	Catfish performance and economics on current and alternative diets. Tank component	$22,176	Arkansas Catfish Promotion Board
R. Lochmann	The effects of Novus dietary supplements (MeraMet Catfish Plus™; Mera Organic Acid blend) in premium or suboptimal 28%-protein diets on the growth, feed conversion, survival, and health of channel catfish fingerlings in aquaria	$16,200	Novus International
R. Lochmann C. Engle S. Pomerleau	Feed performance testing and verification through an industry university partnership	$34,576	Catfish Promotion Board
M.M. Dey	Using national retail databases to determine market trends for southern aquaculture products	$152,000	SRAC
R. Lochmann	Effects of diets supplemented with CLA-enriched soybean oil, standard soybean oil, or marine fish oil on growth, health, feed conversion, survival, body composition, and shelf life of channel catfish	$21,476	Arkansas Soybean Promotion Board
A. Goodwin L. Dorman	Management and prevention of VTC losses	$21,500	Arkansas Catfish Promotion Board
Hart N. Stone A. Goodwin	The four P's of a safe and sustainable aquaculture industry: practices,	$97,900	United Soybean Board

Odierno	presentation, promotion and the press		
R. Lochmann	Improvement of Nile tilapia culture in Tanzania	$97,815	USAID/CRSP
S. Lochmann	Evaluation of vegetation control in Felsenthal National Wildlife Refuge	$10,000	Arkansas Game and Fish Commission
R. Lochmann C. Engle D. Heikes	Feed performance testing and verification through an industry-university partnership work proposed for 2010	$29,576	Arkansas Catfish Promotion Board
C. Engle R. Lochmann	Comparison of alternative (low-cost) and traditional diets for channel catfish	$143,893	USDA
M. Dey S. Larkin T. Hanson B. Chidmi C. Engle	Using retail databases to determine market trends for southern aquaculture products	$250,000	Southern Regional Aquaculture Center
TOTAL 2009		**$1,053,504**	
2008			
A.E. Goodwin	Vectors, viruses, and biosecurity	$150,000	ARS
A.E. Goodwin	Methods to control Derro worm populations in catfish ponds	$8,500	Catfish Promotion Board
A.E. Goodwin	VHS risk in the Southern US	$168,000	APHIS
M.A. Eggleton	The effects of alligator gar re-introductions on crappie and bluegill populations at Mingo National Wildlife Refuge, Missouri	$20,000	Missouri Department of Conservation
R. Lochmann	Improving reproductive efficiency of cultured finfish	$95,500	SRAC
A.E. Goodwin	VHS surveillance in Arkansas	$19,800	AGFC
D. Heikes	Development of a flexible panel fish grading system	$6,656	Arkansas Catfish Promotion Board
S. Lochmann	Evaluation of vegetation control in Felsenthal National Wildlife Refuge	$40,000	Friends of Felsenthal
S. Lochmann	Optimizing propogation methods of larval yellowcheek darter *Etheostoma moorei* at the	$8,000	US Fish and Wildlife - Ecological Services

	Greers Ferry National Fish Hatchery		
C. Engle	Economics and improved production practices for hybrid striped bass and catfish and viral relationships to aquaculture biosecurity	$700,000	USDA-ARS (2008-2009)
A. Haukenes	Establishment of modern educational laboratories in integrative physiology of fishes	$48,720	USDA Capacity Building
S. Lochmann A. Haukenes	Improving reproductive efficiency of cultured finfish	$101,192	SRAC
TOTAL 2008		**$1,366,368**	
2007			
M. Dey & C. Engle	Pond-bank prices of catfish and processor sales volumes	$9,500	Arkansas Catfish Promotion Board
M. Eggleton	Task 2 – Evaluation of dike notching with respect to riverline fish communities and aquatic habitats in pools 2 and 7 of the Arkansas River	$101,004	U.S. Army Corp of Engineers
C. Engle	Improving efficiency of warmwater foodfish and baitfish species	$182,926	Agricultural Research Service-USDA
C.R. Engle & N. Stone	Diversifying catfish production with largemouth bass raised to a size adequate for processing as a new fillet product	$9,000	Arkansas Catfish Promotion Board
C.R. Engle	Development of user-friendly investment models in small and medium-scale commercial aquaculture in developing countries	$16,000	Food and Agriculture Organization of the United Nations
C.R. Engle	Facilitating and coordinating the development of an aquatic nuisance species plan for the State of Arkansas	$40,000	Arkansas Game and Fish Commission
C.R. Engle	Development of a Ph.D. degree program in Aquaculture/Fisheries	$199,547	USDA-Capacity Building Grant
A. Goodwin and L. Dorman	Chemical treatment of dero worms.	$8,500	Arkansas Catfish Promotion Board
A. Haukenes & D. Heikes	Expanding the use of ultrasound technology to	$16,500	Arkansas Catfish Promotion Board

	enhance catfish fingerling production in Arkansas		
R. Lochmann	Effect of commercial diets supplemented with different lipid sources on growth, health, feed conversion, survival, and body composition of channel catfish of different sizes raised under different temperature regimes. Emphasis: diet and feeding strategies for cool and coldwater feeding	$22,920	Arkansas Catfish Promotion Board
R. Lochmann	Comparison of channel catfish production entirely on a plant-protein diet compared to an animal-protein diet	$26,100	Arkansas Catfish Promotion Board
R. Lochmann	The effects of GroBiotic®-A on the growth and health of channel catfish fry in aquaria	$6,200	International Ingredient Corporation
R. Lochmann	Nutrition and feeding strategies to improve egg and fry production of channel catfish	$8,925	Arkansas Catfish Promotion Board
P. Perschbacher	Strengthening aquaculture and fisheries research and educational library (AFREL)	$152,000	Title III
S. Pomerleau	The effect of aeration rates on production and profit of catfish in commercial growth ponds	$90,500	Arkansas Catfish Promotion Board
H. Thomforde	Preparation of educational materials regarding invasive nuisance aquatic snail species	$2,000	Arkansas Catfish Plant Board
TOTAL 2007		**$891,622**	
2006			
Engle, C.	Identifying the causes of failure of catfish value-added products	$15,412	Arkansas Catfish Promotion Board
Engle, C.	Determining the amount of large carryover catfish to depress growth	$11,634	Arkansas Catfish Promotion Board
Engle, C.	Improved warmwater aquaculture products and technologies	$243,750	USDA – ARS
Engle, C. Kaliba, A.	Economic forecasting and policy analysis models for	$50,000	SRAC

	catfish and trout		
Engle, C. Goodwin, A. Stone, N. Pomerleau, S. Sadler, J.	Fish farm epidemiology, feeding and market development	$189,465	USDA – Special Grant
Goodwin, A.E.	Multi-regional koi herpes virus (KHV) education program for U.S. koi and water garden retailers and wholesalers	$13,151	Associated Koi Clubs of America
Goodwin, A.E.	Detection and characterization of aquareoviruses from cyprinids	$18,000	CSRS
Goodwin, A.E.	Trematode management, Year 2	$18,825	Arkansas Catfish Promotion Board
Haukenes, A.H.	Optimizing techniques designed to advance the spawning season in channel catfish.	$10,500	Arkansas Catfish Promotion Board
Haukenes, A.H.	Optimizing techniques for artificial spawning of catfish	$11,000	AFC
Heikes, D.L. Haukenes, A.H.	Demonstrate and document the effect of oxygen saturation equipment on channel catfish fry survival.	$8,800	Arkansas Catfish Promotion Board
Lochmann, R.	Effect of commercial diets supplemented with different lipid sources on growth, health, feed conversion, survival and body composition of channel catfish of different sizes raised under different temperature regimes	$17,070	Arkansas Catfish Promotion Board
Lochmann, R. Lihono, M.	Functional fish as remedy for deconditioned hearts in astronauts	$4,000	Arkansas Space Grant Consortium
Lochmann, R. Sink, T.	Growth and survival of channel catfish fry fed all-plant protein diets	$7,075	Arkansas Catfish Promotion Board
Lochmann, R. Sink, T.	Nutrition and feeding strategies to improve egg and fry production	$29,050	Arkansas Catfish Promotion Board
Lochmann, S.	Task 3 – Relocation of dredged gravel in the Arkansas River to minimize coarse substrates used by a variety of mussels and fish	$96,225	USACE
Neal, J.W.	Targeted training workshops for fisheries personnel of the Arkansas Game and Fish Commission	$1,800	Arkansas Game & Fish Commission
Neal, J.W. Eggleton, M.A.	Integrated teaching and experience (INTEL) laboratory:	$199,017	USDA – Capacity Building

Lee, Y.W. Lochmann, S. Sadler, J.	creating a high-tech learning environment for students Publications, videos and computer software	$2,000	SRAC
TOTAL 2006		**$946,774**	
2005			
C. Engle	Improved warmwater aquaculture products and technologies	288,628	USDA-Agricultural Research Service
C. Engle	Improving performance in warmwater aquaculture	$191,679	USDA-Special Grant
C. Engle, E. Fontenette, K. Quagrainie, P. Perschbacher	Expanding aquaculture graduate program offering: a need for Aquaculture/fisheries research and extension library (AFREL)	$199,843	USDA-Capacity Building Grant
R. Lochmann	Effects of native Peruvian feedstuffs on growth and health of Colossoma and Piaractus	$24,000	U.S. Agency for International Development/Collaborative Research Support Program
W. Neal	Freshwater sport fish management and enhancement	$749,083	Puerto Rico Department of Natural and Environmental Resources
M. Eggleton	National cooperative fisheries scholarship program	$276,642	U.S. Geological Survey-Biological Resources Division
R. Lochmann	The effects of Peck's Natural Blend Daily™ on the performance of channel catfish		Dry Creek Stock Products, LLC
W. Neal	Contract to conduct two in-service training workshops for fisheries personnel of the Arkansas Game and Fish Commission	$3,800	Arkansas Game and Fish Commission
C. Engle	Hybrid catfish production characteristics and economics	$11,800	Arkansas Catfish Promotion Board
C. Engle	Optimal feeding strategies for large stocker catfish in single- and multiple-batch production	$11,634	Arkansas Catfish Promotion Board
C. Engle	Improving retail grocery store sales of catfish in Arkansas through improving packaging and presentation	$13,275	Arkansas Catfish Promotion Board
A. Goodwin	Trematode management	$38,775	Arkansas Catfish Promotion

			Board
D. Heikes	Technology transfer of channel x blue hybrid catfish production techniques	$7,200	Arkansas Catfish Promotion Board
A. Kaliba and C. Engle	Economic analysis of production of various marketable products from catfish offal	$15,400	Arkansas Catfish Promotion Board
D. Heikes	Development and evaluation of pond inventory methods	$65,500	Southern Regional Aquaculture Center
R. Lochmann	Effect of commercial diets supplemented with different lipid sources	$11,200	Arkansas Catfish Promotion Board
S. Pomerleau and D. Heikes	Trawl	$5,560	Arkansas Catfish Promotion Board
TOTAL 2005		**$1,914,019**	
2004			
P. Perschbacher	Travel grant to Marine Baitfish Workshop	$600	Title III
S. Pomerleau	Catfish Research Verification	$58,500	Risk Management Agency (subcontract with Mississippi State University)
K. Quagrainie	Analysis of risk-shifting in the market for farm-raised catfish in Mississippi and Arkansas	$56,024	Risk Management Agency (subcontract with Mississippi State University)
R. Lochmann	Feed formulation and feeding strategies for bait and ornamental fish	$84,619	Southern Regional Aquaculture Center
N. Stone	Feed formulation and feeding strategies for bait and ornamental fish	$56,621	Southern Regional Aquaculture Center
S. Lochmann	Competence and confidence: building professionals by building a museum collection	$199,734	U.S. Department of Agriculture Capacity-Building Grant
J.W. Neal	Enhancement and evaluation of the Arkansas Urban/Community Fishing Program	$12,850	Arkansas Game and Fish Commission
C. Engle, K. Quagrainie, A. Kaliba	An evaluation of the potential market for and uses of catfish offal	$15,000	Arkansas Catfish Promotion Board
A. Goodwin	Reducing stress during fingerling and long distance hauling	$14,950	Arkansas Catfish Promotion Board

J. Kim	Development of channel catfish value-added products	$18,239	Arkansas Catfish Promotion Board
R. Lochmann	Effect of commercial diets for catfish: Year 2	$44,778	Arkansas Catfish Promotion Board
P. Perschbacher, G. Ludwig	Evaluation of new herbicides for impact on fishpond plankton and water quality	$7,000	Arkansas Catfish Promotion Board
C. Engle	Production performance enhancement in aquaculture	$193,155	USDA-Special Grant
C. Engle, A. Goodwin, D. Heikes, N. Stone, K. Quagrainie, R. Lochmann	Improving aquaculture production efficiency	$290,956	USDA-Agricultural Research Service
TOTAL 2004		**$1,053,026**	
2003			
C. Engle	Improving the efficiency of foodfish and baitfish aquaculture	$245,672	USDA-Agricultural Research Service
C. Engle	Cost effective production and marketing strategies for catfish farms	$216,830	USDA-Special Grant
C. Engle	Economic analyses of proposed treatment costs and economic impacts of trout flow-through systems	$11,507	USDA
A. Goodwin	VTC disease of channel catfish	$8,500	Arkansas Catfish Promotion Board
A. Goodwin	Prevention of catfish anemia	$43,250	Arkansas Catfish Promotion Board
A. Goodwin	Diagnosis of SVCV	$4,434.50	USDA-APHIS
C. Engle, N. Stone, S. Pomerleau	Baitfish Yield Verification	$118,874	Risk Management Agency, subcontract through Mississippi State University
D. Heikes, C. Engle	Innovative technologies and methodologies for commercial-scale pond aquaculture	$188,569	Southern Regional Aquaculture Center
P. Perschbacher, M. Lihono, A. Mendoca	Effects of spirulina on the growout, composition and shelf line of GMT tilapia for use in NASA manned space flight	$2,500	School of Agriculture, Fisheries, and Human Sciences
K. Quagrainie, J. Silva	Catfish quality differences and the impact of imports on	$178,714	USDA-Capacity Building Grant

	the U.S. catfish industry		
C. Engle	Innovative technologies and methodologies for commercial-scale aquaculture-economic and financial models for improving catfish production efficiencies	$152,995	Southern Regional Aquaculture Center
A. Goodwin	Detection of latent KHV infections	$5,000	Associated Koi Clubs of America
R. Lochmann	Effect of commercial diets supplemented with different lipid sources	$28,900	Arkansas Catfish Promotion Board
S. Lochmann	Characterization of floodplain lake fish assemblages in the lower White River, Arkansas	$42,000	U.S. Army Corp of Engineers
K. Quagrainie	Preliminary work on site description, evaluation and development planning: Tanzania, Ghana and Kenya	$10,000	U.S. Agency for International Development/Collaborative Research Support Program
TOTAL 2003		**$1,257,745**	
2002			
A. Goodwin	Comparison of the pathogenicity of Columnaris isolates in fish models	$15,000	Southern Regional Aquaculture Center
J. Jackson	An evaluation of the Hooked on Fishing-Not on Drugs program in Arkansas	$15,000	Arkansas Game and Fish Commission
A. Goodwin, C. Engle, N. Stone, R. Lochmann	Evaluation of Alternative strategies for profit-making on fish farms	$217,004	USDA-Special Grant
A. Goodwin	Prevention of catfish anemia	$43,250	Arkansas Catfish Promotion Board
R. Lochmann	Evaluation of the dietary protein requirement for optimum production of Nile tilapia (*Oreochromis niloticus*) in semi-intensive culture ponds	$11,000	U.S. Agency for International Development/Collaborative Research Support Program
C. Engle	Improving the efficiency of foodfish and baitfish aquaculture	$290,617	USDA-Agricultural Research Service
TOTAL 2002		**$591,871**	
2001			

J.R. Jackson, S.E. Lochmann	National Cooperative Fisheries Scholarship Program	$854,464	U.S. Geological Survey-Biological Resources Division
C. Engle, A. Goodwin, J. Jackson	Maximizing production efficiency and economic impact of farm-raised catfish	$222,138	USDA-Special Grant
S. Lochmann, R. Lochmann	Determination of the hazards of isopropyl methylphosphonic acid to channel catfish (*Ictalurus punctatus*) and golden shiners (*Notemigonus chrysoleucas*)	$961,000	Department of the Army
F. Pekar, P.W. Perschbacher	Survey and control of environment-related off-flavors in fish ponds	$8,500	U.S. Hungarian Science and Technology Joint Fund
C. Engle, J. Jackson, R. Lochmann, N. Stone, A. Goodwin, K. Quagrainie	Improving the efficiency of foodfish and baitfish aquaculture	$399,211	USDA-Agricultural Research Service
R. Lochmann	Broodstock diets and spawning of *Colossoma macropomum* and/or *Piaractus brachypomus*	$60,900	U.S. Agency for International Development/Collaborative Research Support Program
R. Lochmann	Nutrition, immunity, economics, and field demonstrations of sunshine bass	$42,846	USDA/IFAFS, subcontract through Kentucky State University
P. Perschbacher	Nutrition, immunity, economics, and field demonstrations of sunshine bass	$29,000	USDA/IFAFS, subcontract through Kentucky State University
C. Engle	Nutrition, immunity, economics, and field demonstrations of sunshine bass	$93,913	USDA/IFAFS, subcontract through Kentucky State University
A. Goodwin	Breeding channel catfish for disease resistance	$22,500	USDA-ARS Catfish Genetics Program
J. Jackson	Development of Indices of Biotic Integrity for Arkansas Ecoregions	$15,000	Tetra Tech, Inc.
K. Quagrainie, C.Engle	A study of Arkansas catfish buyers: perspectives and preferences	$15,000	Arkansas Catfish Promotion Board
N. Stone	Fact sheet on baitfish feeds	$1,000	Southern Regional

	and feeding practices		Aquaculture Center
A. Goodwin	Largemouth bass virus inspection	$4,000	Arkansas Game and Fish Commission
P. Perschbacher	Summer experiential learning exchange program between UAPB and Umatilla tribe fisheries/environmental students	$5,000	Bureau of Land Management
C. Engle	Evaluation of the feasibility of alternative domestic marketing targets for small and medium-scale fish farmers	$139,201	U.S. Agency for International Development/Collaborative Research Support Program
C. Engle	Regional enterprise budget and business plan development	$47,176	U.S. Agency for International Development/Collaborative Research Support Program
TOTAL 2001		**$2,920,849**	

Table 16. Enrollment and Revenue Projections

Item	Year		
	1	2	3
Number of new students	5	3	2
Total enrollment	5	8	10
Tuition revenue	12,800	21,094	27,159
Fees[a]	4,740	7,812	10,057
Total new revenue	17,540	28,906	37,216

[a]Fees are based on UAPB fees for AY 2011 and inflated at 3% per year. Year 1 = 2011.

Table 17. Membership of UAPB National Aquaculture/Fisheries Advisory Council

Voting	Representing
Mr. James Neal Anderson, Chair.	Baitfish Industry
Mr. Mike Freeze, Vice Chair.	Hatcheries
Mr. Cheddy Williamson	Baitfish Industry
Mr. Jim Bland	Baitfish Industry
Mr. James Saul	Baitfish Industry
Mr. Jerald Williamson	Catfish Industry
Mr. Joey Lowery	Catfish Industry
Mr. Jerry Seamens	Catfish Industry
Ms. Louise Peroni	Catfish Industry
Mr. Bob Hopper	Hatcheries
Mr. Jeff Baxter	Hatcheries
Mr. Bari Cain	Hatcheries
Mr. Rick Wohlschlager	Feed Mill
Mr. John Farmer	Feed Mill
Mr. Wayne Branton	Catfish Farmers of Arkansas, Pres.
Mr. Bo Collins	Catfish Farmers of Arkansas, Exec. Dir.
Mr. Willie Booker	UAPB Alumni
Dr. Eric Park	AR Bait & Ornamental Fish Growers Assn.
Mr. Scott Henderson	Arkansas Game & Fish Commission
Mr. Mike Armstrong	Arkansas Game & Fish Commission
Mr. Don Brader	Arkansas Game & Fish Commission
Dr. Bill Simco	University
Dr. Rob Romaire	University
Dr. Bill Shelton	University
Ex-officio Members	
Dr. L. A. Davis, Jr.	Chancellor, UAPB
Dr. Mary Benjamin	Vice Chancellor for Academic Affairs
Ms. Pauline Thomas	Interim, Vice Chancellor for Fiscal Affairs
Mr. Elbert Bennett	Vice Chancellor for Student Affairs
Dr. James O. Garner	Interim, Dean/Dir., Ag, Fish. & Human Sci.
Dr. Milo Shult	Vice President for Agriculture
Dr. B. Alan Sugg	President, University System
Dr. Ivory Lyles	Assoc. Vice President for Extension
Mr. Ted McNulty	Vice Pres. for Agri./Aqua.
Dr. James Fleming	U. S. Geological Service
Dr. Dan Upchurch	USDA, ARS
Mr. Torré Anderson	U. S. Fish & Wildlife Service
Dr. Jeff Silverstein	USDA-ARS
Mr. Hannibal Bolton	U. S. Fish & Wildlife Service
Dr. Craig Tucker	SRAC
Dr. William Slikker, Jr.	Natl. Ctr for Toxicological Research
Dr. Herbert Monoson	AR Science and Technology Authority

Ms. Becky Cross	AR Agricultural Statistics Service
Mr. Gene Martin	AR Farm Bureau
Mr. Jack Kilgore	U.S. Army Corps of Engineers

Figure 1. Number of Refereed Journal Articles, UAPB Aquaculture/Fisheries Center, 1985-2010

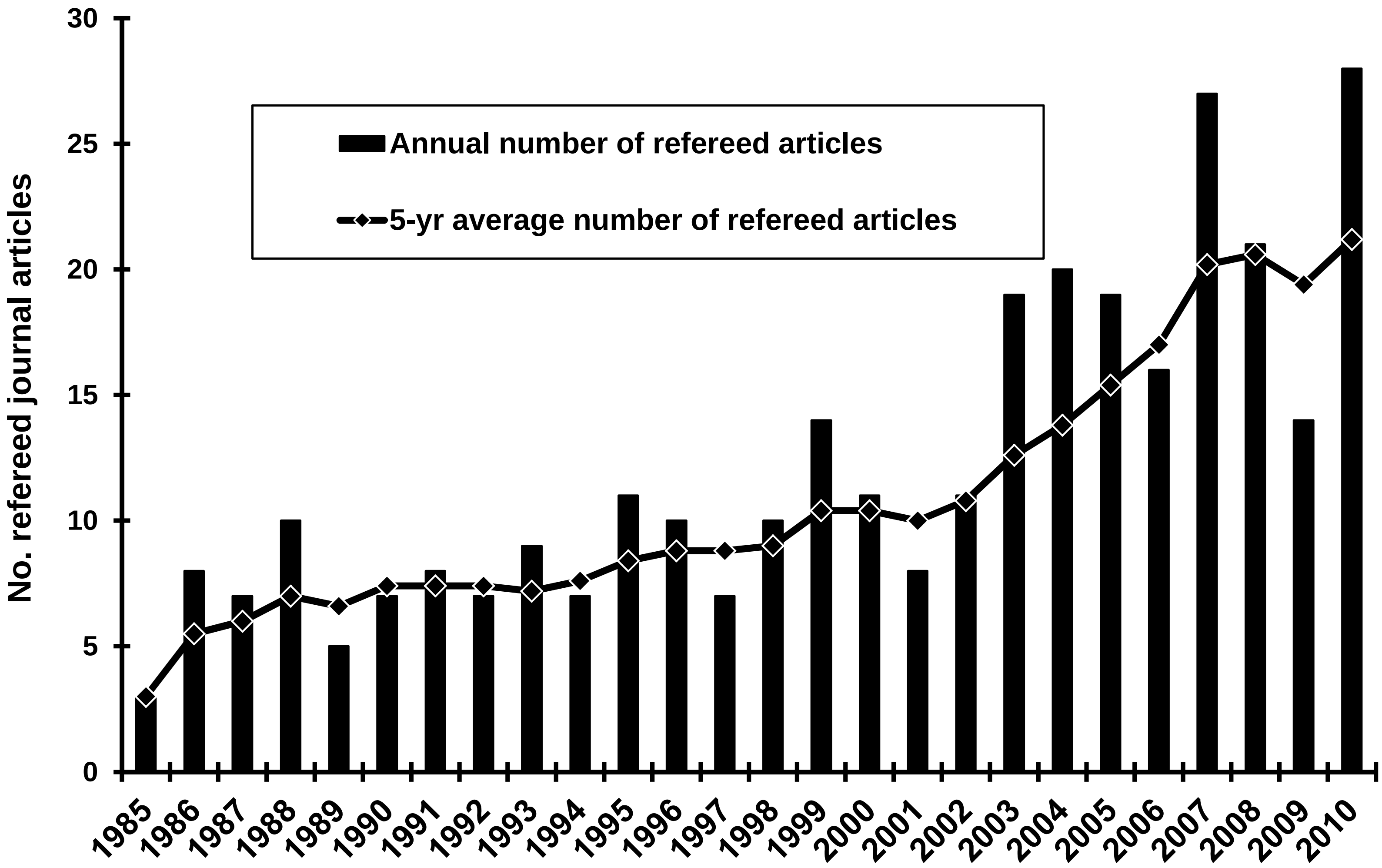


Figure 2. Graduates from M.S. Degree Program in Aquaculture/Fisheries

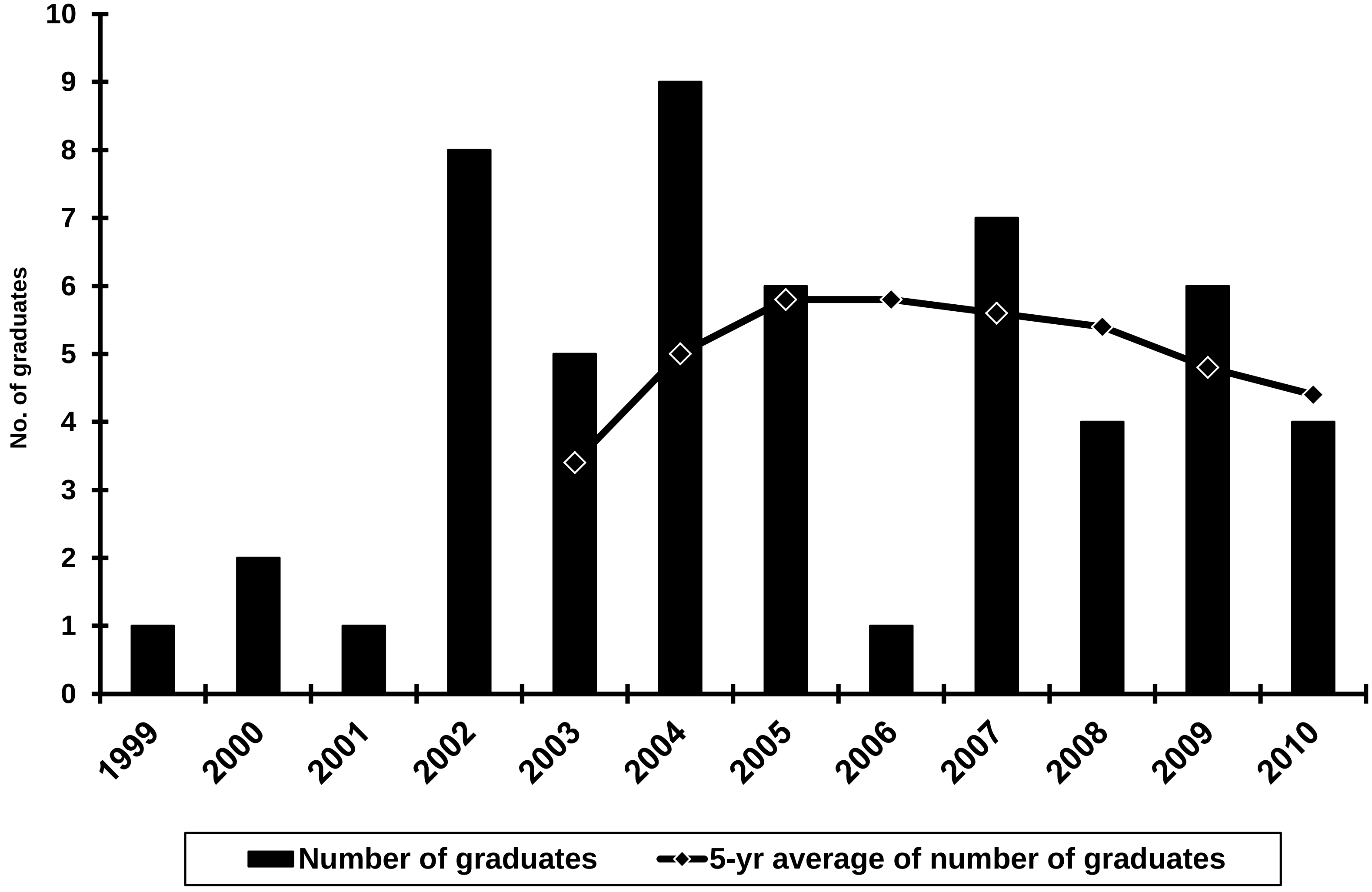


Figure 3. Assessment Milestones for Ph.D. Students in the Department of Aquaculture and Fisheries.

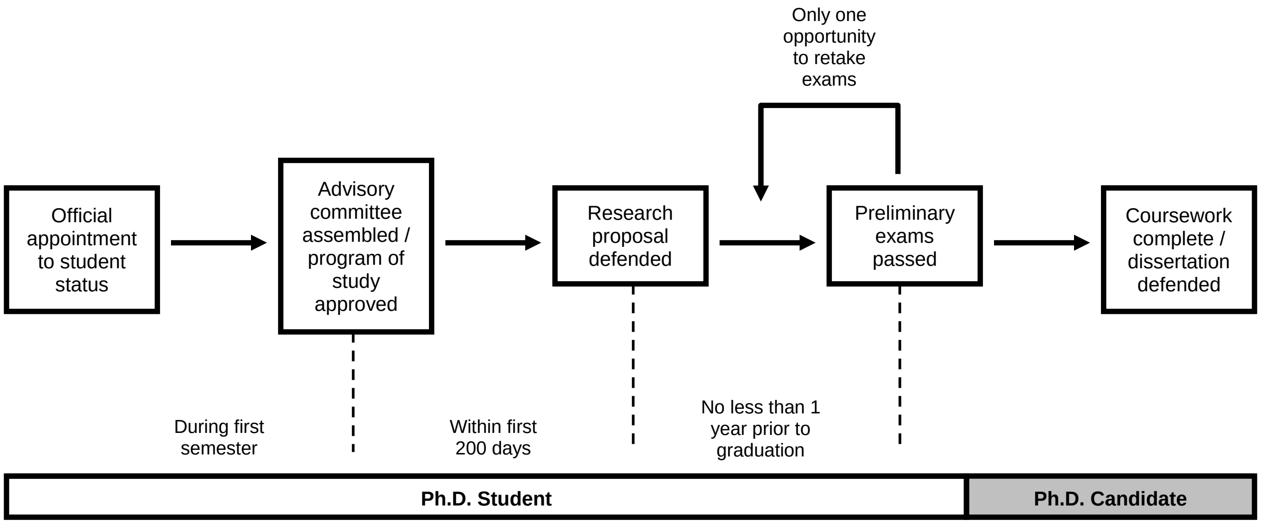
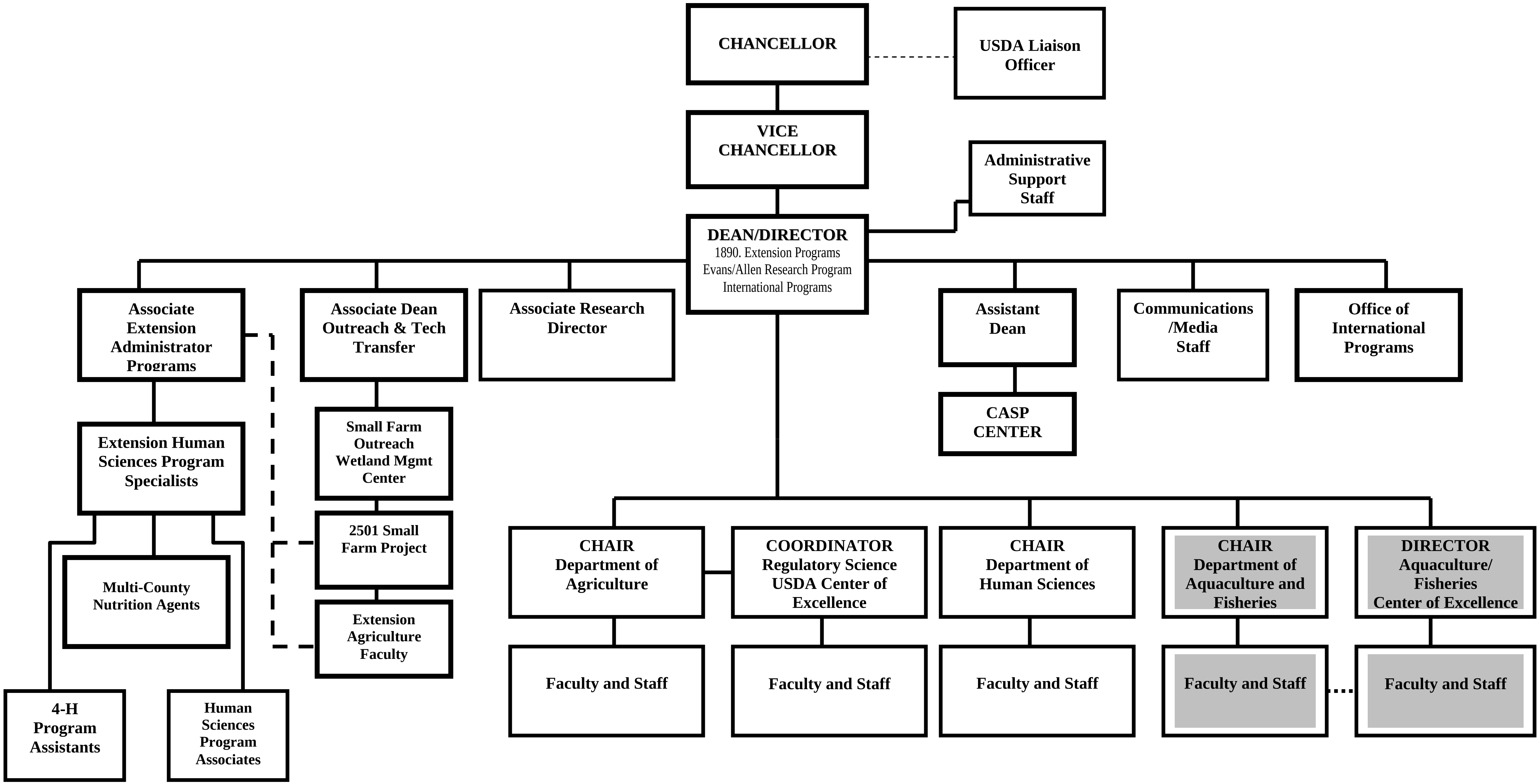


Figure 4. Organizational Chart. The Ph.D. Program in Aquaculture/Fisheries Will be Administered within the Department of Aquaculture and Fisheries



Appendix A
Mission Statement of the Aquaculture/Fisheries Center

The Aquaculture/Fisheries Center of Excellence is a research and extension center dedicated to the development and transfer of timely, problem-solving information. The primary mission is to respond to immediate and future needs of the state's aquaculture industry, and fisheries and aquatic resource managers through quality research and extension programs. The primary stakeholders and beneficiaries of the Center are aquaculture producers, aquaculture support industries, farm pond owners, county Extension agents, and natural resource managers (particularly of state and federal agencies), undergraduate and graduate students of the Department of Aquaculture and Fisheries. Other residents of Arkansas are secondary beneficiaries that are reached through their interactions with our stakeholders. UAPB is the only state-supported institution of higher education in Arkansas that has statewide responsibility for both research and extension in aquaculture and fisheries.

The Center and Department are dedicated to (1) applied aquaculture and fisheries research; (2) dissemination of scientifically-proven results through extension and advanced educational techniques that contribute to the economic development of the Delta region and the state; (3) the aquaculture industry of Arkansas; 4) undergraduate and graduate aquaculture and fisheries education; and (5) the responsible management and conservation of aquatic resources in Arkansas.

UNIVERSITY OF ARKANSAS AT PINE BLUFF

AQUACULTURE/FISHERIES CENTER OF EXCELLENCE and DEPARTMENT OF AQUACULTURE AND FISHERIES

APPENDIX B - STRATEGIC PLAN 2007-2011

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Part II: Five Year Strategic Plan for the Aquaculture/Fisheries Center of Excellence 2007-2011

Excellence in Teaching
Excellence in Research
Excellence in Extension
Maintain an Effective Infrastructure

Appendix

PART I

MISSION STATEMENT AND BACKGROUND OF THE AQUACULTURE/FISHERIES CENTER OF EXCELLENCE

AQUACULTURE/FISHERIES CENTER OF EXCELLENCE and DEPARTMENT OF AQUACULTURE AND FISHERIES

Background

The Aquaculture/Fisheries Center and the Department of Aquaculture and Fisheries are administered jointly to provide an integrated university team dedicated to solving the problems of the state. Administratively, research and extension activities occur within the structure of the Center, while academic responsibilities related to the undergraduate and graduate programs are administered through the academic department.

The Aquaculture/Fisheries Center of Excellence at the University of Arkansas at Pine Bluff (UAPB) was created in 1988 by the Strategic Planning Council of the University of Arkansas System as part of its plan for economic growth and development. The rapid growth of the aquaculture sector in Arkansas and its positive impact on the economy of the Mississippi delta region of the state resulted in a critical need for a strong Aquaculture/Fisheries program within the University of Arkansas System. The location of the Pine Bluff campus in the heart of the aquaculture industry, existing supportive infrastructure and facilities, and a commitment to aquaculture teaching, research and extension combined to make UAPB the logical choice for creating the Aquaculture/ Fisheries Center of Excellence.

The catfish, bait minnow and Chinese carp industries were first established in Arkansas and fourth generation fish farmers continue the rich history of fish farming in the state. Today, Arkansas leads the nation in production of bait minnows, Chinese carps, hybrid striped bass fry and fingerlings, largemouth bass foodfish, and is second only to Mississippi in catfish production. The total economic impact of aquaculture in Arkansas exceeded $1.3 billion in 2005. Much of the economic activity generated by aquaculture is in the Delta region that is characterized by high rates of poverty and unemployment. Continued growth of the Arkansas aquaculture industry will depend upon its ability to overcome new and emerging problems. Strong university research and extension programs are needed to find solutions and provide a scientific foundation for a strong and competitive industry.

Arkansas residents enjoy a diversity of types of aquatic natural resources that include large and small impoundments, farm ponds, large rivers (Mississippi, Arkansas, White), and bayous and streams. As the “Natural State,” Arkansas seeks to further develop tourism opportunities as well as recreational uses of aquatic natural resources. Appropriate science-based management of these resources will enhance benefits of the citizens of the state through direct access to the recreational benefits offered and also through the revenue generated through tourism. Recreation creates over $200 million in direct revenue in the upper Mississippi River and over 3,000 jobs of which 31% is generated by recreational fishing. The magnitude of the impact in the lower Mississippi River is likely to be similar. Research and extension programs are vital to maintain effective and successful management programs. Enhancing recreational fishing opportunities in the Delta region has potential to increase tourism in the area that would contribute to much-needed economic development in the region.

The Aquaculture/Fisheries Center of Excellence at UAPB is recognized nationally as a leader in aquaculture/fisheries teaching, research, and extension programs. The current strengths, commitment of administrators and faculty provide a foundation for further development and statewide benefit.

Aquaculture and fisheries extension programs in Arkansas are designed and implemented through the Aquaculture/Fisheries Center. Programs, however, are delivered through Arkansas Cooperative Extension Service (ACES) county Extension agents. An agreement between the ACES and UAPB details the responsibilities and commitments of each entity in responding to the extension educational needs of the state in this area.

The U.S. Department of Agriculture also selected UAPB for the USDA Aquaculture Center of Excellence in 1993. Co-location of the ARS Center of Excellence in Aquaculture began in 1994 with the establishment of a two-scientist unit. The Aquaculture Systems Research Unit focuses on high-priority areas of aquaculture systems management from the pond bank through postharvest handling and processing of aquatic food products.

The University of Arkansas at Pine Bluff, as a historically black university (HBCU), has an historic mission to serve the state's poorer classes with a special sensitivity to African-American populations. Over time, the historic mission has evolved to provide science and technology-based teaching, research, and extension services to the entire state in a number of different areas. The UAPB Aquaculture/Fisheries Center is the only HBCU that has responsibility to provide comprehensive teaching, research, and Extension support for aquaculture and fisheries in a major aquaculture-production state. As such, and in consonance with the University's historic and expanded mission, the Center maintains sensitiveness to the needs, aspirations, problems and opportunities of UAPB's historic constituents as well as contemporary society's more culturally heterogeneous clientele.

In 1997, the Department of Aquaculture and Fisheries was created in recognition of the growing needs of the specialized degree programs in the area. With the creation of the academic department, academic teaching functions are administered through the department while research and extension activities are administered through the Center. These two units are co-administered to avoid duplication and conflict over resources and personnel time allocations. The academic department is responsible for issues related to the teaching program and to both the undergraduate and graduate student programs. Research and extension appointments, funding, and activities are carried out through the Aquaculture/Fisheries Center. Most faculty have joint appointments that correspond to teaching versus research and extension responsibilities. The Department of Aquaculture and Fisheries offers the state's only undergraduate major in Fisheries Biology and the only M.S. degree in Aquaculture/Fisheries.

Mission Statement

The Aquaculture/Fisheries Center of Excellence is a research and extension center dedicated to the development and transfer of timely, problem-solving information. The primary mission is to respond to immediate and future needs of the state's aquaculture industry, and fisheries and aquatic resource managers through quality research and extension programs. The primary stakeholders and beneficiaries of the Center are aquaculture producers, aquaculture support industries, farm pond owners, county Extension agents, and natural resource managers (particularly of state and federal agencies), undergraduate and graduate students of the Department of Aquaculture and Fisheries. Other residents of Arkansas are secondary beneficiaries that are reached through their interactions with our stakeholders. UAPB is the only state-supported institution of higher education in Arkansas that has statewide responsibility for both research and extension in aquaculture and fisheries.

The Center and Department are dedicated to (1) applied aquaculture and fisheries research; (2) dissemination of scientifically-proven results through extension and advanced educational techniques that contribute to the economic development of the Delta region and the state; (3) the aquaculture industry of Arkansas; 4) undergraduate and graduate aquaculture and fisheries education; and (5) the responsible management and conservation of aquatic resources in Arkansas.

Goals

Teaching

Teaching goals for the Department of Aquaculture and Fisheries include:

1. To educate students to acquire critical aquaculture skills to prepare them for employment in areas such as state and federal hatcheries, the fish farming industry on fish farms, in processing plants, feed mills, and in other aquaculture support industries.

2. To educate students in essential areas of fisheries management, aquatic ecology and related disciplines for employment in state and federal agencies as well as the private sector.

3. To prepare undergraduate and graduate students to pursue advanced degrees in diverse areas that include aquaculture, fisheries, agriculture, veterinary medicine, toxicology, ecology, and other related sciences.

4. To add facilities, personnel, and equipment as required to support continuing improvements in educational efforts.

Research

Research goals for the Aquaculture/Fisheries Center include:

1. To conduct proactive and responsive research focusing on solutions to priority problems and constraints of Arkansas aquaculture growers, processors, feed mills, and other aquaculture support industries.

2. To conduct research on priority issues of fisheries management to enhance recreational fisheries to benefit natural resource managers (particularly of state and federal agencies) and residents of Arkansas.

Extension

Extension goals for the Aquaculture/Fisheries Center include:

1. To provide technical support to county agents in aquaculture and related aquatic fields.

2. To provide research-based information, education, and service in areas related to aquaculture.

3. To facilitate the development and advancement of the aquaculture industry in Arkansas.

4. To provide recommendations and technical information on the management of farm ponds, community fishing, and management programs.

5. To provide research-based information, education, and service in areas related to the management of fisheries resources with specific emphasis in the areas of recreational fishing, farm pond management, community and urban fishing, and youth fishing.

Objectives

Teaching

Objectives of the Department of Aquaculture and Fisheries include:

1. To provide students with a thorough understanding of the principles of aquaculture production and management.

2. To provide students with a thorough understanding of the principles of fisheries and natural resource management.

3. To provide experiential learning opportunities for students in practical real-world aquaculture techniques.

4. To provide experiential learning opportunities for students in practical real-world fisheries and natural resource management techniques.

5. To utilize distance education technologies to provide off-campus access to the department's academic courses.

Research

Research objectives of the Aquaculture/Fisheries Center include the following:

1. To conduct research on hatchery management techniques, pond production practices, and water quality issues of aquaculture.

2. To conduct research on diseases, parasites, well being, and health of aquaculture species.

3. To conduct nutritional research on current and potential aquaculture species in the areas of nutritional requirements, diet formulation, and feeding practices.

4. To conduct research on the development, economics, marketing, and finance of diverse aquacultural commodity sectors.

5. To conduct research on food product technology and food science problems of aquaculture industries.

6. To conduct research on engineering problems related to aquaculture production and distribution systems.

7. To conduct research on fisheries management issues and problems in warmwater impoundments and natural waters of the state.

Extension

Extension objectives of the Aquaculture/Fisheries Center include the following:

1. To prepare written and audiovisual educational materials for use by county agents.

2. To assist county agents to plan and to present educational meetings for producers and other groups involved in aquaculture.

3. To serve in a liaison advisory capacity to producer associations and state agencies on matters related to aquaculture.

4. To provide water quality and disease diagnostics services and related educational programs to aquaculture producers.

5. To conduct aquaculture research verification trials and demonstrations where appropriate.

6. To facilitate flow of technical information from researchers to farmers and identify and communicate critical practical problems to researchers for planning scientific studies.

7. To assist county agents, 4-H leaders, and educators to plan and to present educational meetings and activities for landowners and youth groups in the areas of farm pond management and recreational fishing.

8. To assist county agents to plan and to present educational meetings related to water gardening.

9. To develop, field test, and disseminate information on Good Management Practices in aquaculture.

10. To assist natural resources managers in areas of program evaluation, continuing education, and preparation and dissemination of educational materials to support management programs.

11. To provide science-based information relevant to discussions on policy and regulatory issues to industry representatives and to policy and regulatory agencies.

Personnel

Over the period 2002-2006, six new positions have been added to the Center over the past five years. These include the two recommended faculty positions in biometrics and applied fish reproductive physiology (hatchery management), both with split teaching and research appointments. In Extension, the Associate position for Research Verification has been upgraded to a Specialist position. Additional support positions include: two program coordinators, one to develop and prepare reports and inventory files and the other to provide clerical and support services to the undergraduate program (the former accountant position in the department was converted to this position when an accountant in Fiscal Affairs was designated for Aquaculture/Fisheries), and an additional farm worker position for the Aquaculture Research Station. In all, there were 12 Ph.D. faculty, four M.S. level extension specialists, three post-doctoral scientists, eight M.S. level staff, nine B.S. level staff, and five other support personnel in 2006. At the time the plan was written, there were three vacant positions (Assistant Professor-Marketing; Assistant Professor-Applied Fish Reproductive Physiology; Food Technologist). Many of the faculty-level personnel hold joint appointments with varying time percentages among teaching, research, and extension responsibilities.

Of the faculty-level positions, nine hold teaching appointments in the Department of Aquaculture and Fisheries, an increase of two over the past five years. These faculty members are specialized in the areas of fish health, fish nutrition, aquaculture, aquaculture economics, aquaculture marketing, larval fish ecology, fisheries science, and management of impoundments. Two of these faculty members serve as Undergraduate and Graduate Coordinators. The Coordinators schedule classes, are the first point of contact for the department in terms of applications, scholarship information, and program requirements. In addition, they serve as advocates across the program for initiatives of importance to students enrolled in the respective degree programs. There are no teaching assistants to support the teaching program.

Fourteen faculty-level personnel hold research appointments in the Aquaculture/Fisheries Center. These faculty specialize in the following research areas: fish health, fish nutrition, pond and hatchery management, water quality, aquaculture systems research, aquaculture economics, aquaculture marketing, aquaculture engineering, larval fish ecology, fisheries science, and management of impoundments. This represents an increase of two scientists involved in research, two under UAPB's administration and one new ARS position in food technology. The two ARS scientists are co-located at UAPB as part of the USDA Center of Excellence in Aquaculture.

There were nine support staff positions assigned to individual researchers in 2006. Of these, three are paid 100% from base funds, one is paid 50% from base funds, and the others are paid 100% from grant funds. From time to time, additional support staff are hired full-time for several months from grant funds. Two additional support staff members, one a M.S. technician, and the other a B.S.-level position support the ARS scientists. Additional support for the research program includes a computer specialist, pond manager, and two support personnel assigned full-time to the Aquaculture Research Station.

There were seven faculty-level Extension specialist positions in the program in 2006. This represents an increase of one specialist over the last five years. The new specialist position was created to upgrade the Research Verification Coordinator position from a

Research Associate to a specialist position. The expansion of the Research Verification program to include baitfish in addition to catfish and the anticipated long-term commitment to this program warranted the upgrade, to match the position title with the level of responsibility expected from the position. The Lonoke laboratory was also fully staffed in 2006, with both specialist-level positions (water quality and fish health) filled.

Extension faculty are supported by another three faculty members with part Extension appointments in specialty areas such as fish health, aquaculture economics and marketing, and recreational fishing. An additional four M.S. level support staff support extension faculty. Of these, 3.5 F.T.E.'s are supported through base funds and 50% of one position from external funds. There was no change in support personnel in the extension area over the past 5 years.

Administrative support is provided through five clerical support staff in 2006. This is the same overall number of individuals as in 2001. However, an evaluation of responsibilities, position titles, and salaries that was prompted by recommendations in the 2001-2006 plan resulted in a re-organization in this area. Currently, there is a Secretary I in the S.J. Parker Agricultural Research Center to support faculty and staff with offices in that building, an Assistant Specialist-Management in the S.J. Parker 1890 Extension Complex to support personnel in that building, an Administrative Secretary who serves as the departmental secretary, a Program Coordinator who prepares program information, report summaries, and compiles reports requested from other offices in the university, and from state and federal agencies, and a Program Coordinator who supports the BRD program, the undergraduate program, and other faculty located in Woodard Hall. The Lonoke and Lake Village offices each are supported by a percentage (10-25%) of a secretary's time.

Facilities

The heart of the aquaculture research component of the Aquaculture/Fisheries Center is the Aquaculture Research Station that is located just north of the UAPB campus. It is located on the 212-acre agricultural research farm and includes 113 earthen ponds ranging in size from 0.1 to 0.5 acres each. A 5-acre reservoir is used for water storage and supply, and a 5-acre farm pond is available for cage studies. There are 35 ponds of 0.1-acres of which 14 are covered with bird netting to exclude predators from minnow studies. A 1-acre pond is used for small impoundment demonstrations. Seventy-one 0.25-acre ponds provide the bulk of experimental and holding facilities at the station. Water is supplied by two shallow wells (Alluvial Aquifer) and two deep wells (Sparta Aquifer). Electrical service is available to all ponds. Forty plastic-lined, steel-rimmed, nine-foot diameter outdoor pools are used for nutrition, fish health, and water quality studies. A roof-covered fish holding facility that consists of eight roof-covered vats (17' x 4' x 3') on a 1600 sq. ft. concrete slab is used for fish health checks, grading, and teaching purposes.

Further research may be conducted in 40 nine foot diameter pools covered with bird netting. This unit is frequently used for nutrition studies and pilot studies with minnows and ornamental fish.

UAPB also has an 871-acre farm north of Lonoke, Arkansas. This farm includes 200 acres of fish ponds (13 earthen ponds ranging in size from 10 to 29 acres), a grading shed and eight electric wells. A Memorandum of Understanding was signed in 2001 with the Arkansas Game and Fish Commission to jointly manage the ponds for youth fishing education and recreational fishing management research.

Support facilities on the UAPB campus include a hatchery building (5,400 sq. ft.) with an 1,800 sq. ft. aquarium and tank room and a 2,000 sq. ft. holding tank facility. Other storage buildings for feed, chemical, net, tool, and farm equipment are also located at the aquaculture research site. The hatchery building is the oldest and largest building at the station (5400 sq. ft.). It is equipped with its own deep water well and houses a variety of tanks and systems. Catfish are hatched here for station study use. Experimental work on innovative hatching systems for minnows and goldfish was done in the building. One room of this building has been equipped for nutrition studies, including a recirculation system for nutrition research to test fish and diets under different temperatures. New storage facilities were added in 2004.

The Value-Added Product Development and Demonstration Building, built in 2000, is a multi-purpose structure with both research and extension objectives. The laboratory portion of the building is a food processing/kitchen lab where catfish, shrimp and crayfish are developed into new products and tested. This laboratory will be used for food product technology research and demonstration projects. A second portion of the building provides an extension conference room that doubles as a breakroom for research station personnel on a daily basis.

The Aquaculture Equipment Development Building is an 1800 sq. ft. shop building equipped with welding and basic metal fabrication tools. It has been used to develop in-pond grading equipment, a seine reel to sanitize harvesting nets, an improved seine boat to improve crowding and handling of fish at harvest and a hydraulically-powered trawl system for sampling commercial ponds.

A new research laboratory building, the Hatchery Research and Demonstration Building was completed at the Aquaculture Research Station in 2005. This laboratory is designed to accommodate research and demonstration in the areas of hatching fish and water quality. The facility is divided into dry labs and two wet labs that can be combined or separated in a variety of permutations to allow experimentation with temperature variation from lab to lab, depending upon species under investigation. This lab fulfills a specific recommendation in the previous plan to create additional laboratory space for researchers.

The USDA-ARS water chemistry laboratory houses state-of-the-art chemical analysis machinery. Geared to perform a variety of tests of water chemistry parameters, the laboratory houses computers, spectrophotometers, fume hoods, and controls to the data logging and aeration systems for all ARS study ponds.

The UAPB 1890 Research and Extension program includes two buildings that house offices, the fisheries library, and additional laboratory space. The S.J. Parker Agricultural Research Center includes a 1,000 sq. ft. wet laboratory, complete with aquaria and tanks, that is adjacent to a 700 sq. ft. water quality and plankton analysis laboratory. Studies on fish nutrition are conducted in a separate 1,000 sq. ft. laboratory (also in the S.J. Parker Agricultural Research Center), which contains a walk-in cooler and freezer and an ultracold freezer for sample storage, and equipment for preparation of experimental diets, and instrumentation for analysis of feeds and tissues. The S.J. Parker 1890 Extension Complex houses a 1,153 sq. ft. fish health research and diagnostic laboratory with 100 aquaria for disease research.

Support facilities for natural fisheries research include a 2,256 sq. ft. laboratory and a 2,400 sq. ft. boat storage facility. The fish shop includes a wet lab with five independent recirculation systems (eight 20 gallon aquaria per system) and twenty 170 liter flow-through polytanks in a light-controlled environment. Tanks and aquaria may be regulated for temperature, oxygen, light, and inflow of water. A 504 ft^2 dry lab is available to process samples acquired during field sampling. This area includes equipment for the analysis of otoliths and spines, and freezers for sample storage. There is a large equipment storage area that includes backpack electrofishing equipment, state-of-the-art tagging equipment, ploidy manipulation equipment, and more; and a processing laboratory that includes wet sample areas, standard microscopy, and an image analysis station. Eight all-purpose aluminum boats ranging in size from 10 to 18 feet in length with 2.5 to 60 horsepower motors are housed in a 2,400 sq. ft. storage facility. Three are set up for electrofishing. Collection gears of many types are available, including gill, trap, and hoop nets, trawls, seines, purse seines, and ichthyoplankton tow nets. The Boat Barn is enclosed by a gated fence and has ample parking for vehicles and boats.

A new boat shed has been constructed in the area next to the Fish Shop and the entire compound has been fenced. The shed will be used for boat and equipment storage for the natural fisheries program.

Classes are taught in Woodard Hall on the UAPB campus. Woodard Hall is the agriculture building and is one of the older buildings on the campus. It has been renovated recently and was re-occupied at the end of 2005. The classroom is equipped with computers and another small computer lab has been established for undergraduate students in Woodard Hall. A room has been designed to serve as the departmental library. Funding from a USDA grant provides for hiring an individual to manage the library. The Watson Brown Memorial Library on campus is working with the Library Committee of the department to turn this area into a branch library of the main library. The library is intended to be focused on electronic access to journals.

Laboratories for classes in Aquaculture and Fisheries are available in the Holiday Hall Applied Sciences Building that opened in the fall of 2001. Laboratories for dissection and analytical exercises are available in addition to wet laboratories for holding fish and for students to conduct experiments in aquaria. One of the wet lab areas has been set up with tanks and filters for use. The other has the proper flooring and connections, but is not yet equipped. Plans are underway to plan for the best type of facilities to install for the classes that need wet lab access. The building also contains an area that is under development as a fish museum.

Extension facilities include four diagnostics laboratories located at UAPB (1890 Extension Building), Chicot County Extension Office, Lonoke County Extension Office, and on the campus of ASU at Newport. All laboratories are equipped to conduct water quality, microbiological, and parasitological analyses of fish samples. The laboratory on the UAPB campus is further equipped for viral analysis, histological analysis, and for advanced molecular biological techniques of analysis. A workshop facility has been constructed at the Aquaculture Research Station to support the aquaculture engineering research and development on fish grading and harvesting equipment.

Summary of Progress Over the Last Five Years

The last five years have included advances in a number of areas. These include expansion of the ARS unit, acquisition of additional laboratory space, consolidation of the graduate program, expansion of expertise in the areas of food technology (through the ARS unit), biometrics, applied fish reproductive physiology, and enhanced clerical support through re-organization of responsibilities.

The ARS Aquaculture Systems Research Unit filled a Food Technology position with funding retained from UAPB's pass-through funding (because UAPB had not been able to acquire a postdoctoral scientist slot at the time; since that time, the Center administration has developed mechanisms to hire postdoctoral scientists and, at the time of writing this plan, there were three postdoctoral scientists in the Center) and initiated a research program focused on the development and testing of new value-added products from catfish. However, that position was vacant again at the time this plan was prepared.

A critical mass of scientists to work on management of fisheries resources was brought together during the previous 5-year planning period. The importance of natural resources to Arkansas is reflected in the state's emphasis on tourism, and in the high level of interest in fishing and hunting. Yet the management options for fisheries resources of the southern part of the state in particular have not been well studied and there is a strong need for research on the fisheries of these areas to improve management of these resources. A focus group of a wide range of stakeholders was convened in 2002 to identify key problem areas. The group discussed a wide range of issues and problems and developed lists of priority areas. From this input, the Arkansas Game and Fish Commission was selected as the primary stakeholder, with the U.S. Fish and Wildlife Service as the secondary stakeholder. A priority program area entitled Recreational Fishing in the Delta was developed and submitted to USDA for the Center's plan of work. Center funding has since been targeted towards this program since then. However, this area has not developed into the high-impact area as had been projected.

Possible reasons for this may include:

1. Scientists who work in the areas of natural fisheries typically are trained outside the land-grant system, frequently do not embrace the land-grant mission or stakeholder-driven research and may even view stakeholder-driven research as too “human-centered” instead of being centered on the ecology/environment.

2. The Arkansas Game and Fish Commission, identified as the major stakeholder for this area historically has not looked to universities nor depended upon universities for research from which to base management decisions. Consequently, research has not been a priority budget item. Some research projects are funded to AGFC staff, internally.

3. Turnover of faculty in this area also slowed program development.

The M.S. degree program in Aquaculture/Fisheries has moved beyond the implementation phase and is now well established. The Arkansas Department of Higher Education criterion of an average (5-yr moving average) graduation of three students was reached in May, 2002, 4.5 years from enrolling the first students in the program and has been exceeded each year since then. Students are moving through the program and most complete their work within 2.5 years. The only policy changes that have been implemented have been to shorten the time period within which the student must finalize and defend their proposal defense and to require students who take a job prior to graduating to continue to pay for an hour of tuition to remain in the program. This last policy change resulted in a number of students returning to complete theses prior to having to pay additional tuition.

Progress has been made in acquiring adequate laboratory space for scientists. The lack of laboratory space has been a major constraint to the program over time. The construction of the Applied Sciences Building provided two research laboratories for Aquaculture/ Fisheries scientists over the period of the previous plan. USDA facilities funds were used to construct the Hatchery Research and Demonstration Building at the Aquaculture Research Station, providing laboratory facilities for two additional research scientists.

The acquisition of state funding to match the USDA funding allocations has fueled much of the growth and expansion of the Center. State funds played a critical role in implementing the first two stages of salary equalization efforts (faculty and non-classified staff). These are needed to retain the high-quality faculty in the Center. As their reputations have grown, their employment opportunities have grown also. Additional efforts are needed to bring salaries of classified staff up to competitive levels.

The lack of teaching assistantships to support the efforts of teaching faculty has been a major contributor to faculty morale problems. Enrollment in the graduate program is such that there should be adequate tuition revenue to fund several teaching assistantships as specified in the proposal creating the program. Yet, the annual requests to fund a few teaching assistantships consistently have been turned down.

Appendix Table 1 summarizes the recommendations from the previous 5-yr strategic plan (2002-2006). The table indicates those recommendations that were accomplished and which were not.

PART II

FIVE-YEAR STRATEGIC PLAN FOR THE AQUACULTURE/FISHERIES CENTER OF EXCELLENCE

2007 – 2011

FIVE-YEAR STRATEGIC PLAN FOR THE AQUACULTURE/FISHERIES CENTER OF EXCELLENCE 2007 – 2011

Excellence in Teaching

Goal #1. Provide a superior education experience for undergraduate students majoring in Fisheries Biology.

Enrollment in the B.S. degree program has been maintained at a relatively low level since about 1998. The declines in enrollment/graduation rates from the peak period of 1995-1997 are not entirely clear. One of the distinct differences between the current time period and the previous period is the lack of students transferring in from the biology department. At one time, an instructor from Aquaculture and Fisheries taught the Ecology class and recruited a number of students through it and through the BRD internship program (a number of transfer students began working as BRD interns before deciding to transfer in to Aquaculture and Fisheries). The development of the Regulatory Science program may also have siphoned off the students from Biology who used to transfer to Fisheries. Nevertheless, a revamped recruitment plan and initiative over the last several years has resulted in some increases in enrollment with the majority of the department’s students now in the freshmen and sophomore classes.

Recommendations (Undergraduate Coordinator responsibilities):

1. Provide a comprehensive education that includes good oral and written communication skills.

2. Provide a continually updated curriculum that is relevant to the current technology status and issues related to Fisheries Biology and Aquaculture.

3. Provide quality instruction and advising for our students.

4. Provide excellent facilities for laboratory practicums and practical experience in areas that include: fisheries biology, fisheries management, aquaculture, fish reproduction, rearing of larvae of aquatic species, general and aquatic ecology, aquaculture product development, and aquaculture economics and marketing.

5. Work with the Office of Career Services to keep students informed of internship, cooperative education, and job opportunities with employers.

6. Increase total enrollment in the B.S. degree program in Fisheries Biology to a minimum of 40 students by the 2008-2009 academic year.

7. If we do not meet the targeted enrollment by the 2008-2009 academic year, the department will engage in a serious evaluation of potential options relative to the B.S. degree in Fisheries Biology.

8. Improve the student retention rate to 82% over the next 5 years.

9. Increase the number of graduates to 5 per year.

10. Initiate a faculty/staff forum for students to interact with departmental administration and faculty on a regular basis.

11. Enhance support for activities for the AFS student subchapter.

12. Develop criteria for a minor in Fisheries Biology.

13. Implement a successful NCFS (formerly referred to as BRD) Scholars program as outlined in the agreement with USGS-BRD.

14. Ensure that the B.S. Degree curriculum continues to meet criteria established by the American Fisheries Society and the U.S. Aquaculture Society, a subchapter of the World Aquaculture Society.

15. Maintain the computer room for undergraduate students.

16. Develop and implement an exit survey for graduating students.

17. Develop and implement a survey of graduates working in the field.

Goal # 2. Continue to offer a superior M.S. degree program in Aquaculture/Fisheries.

Recommendations (Graduate Coordinator responsibilities):

1. Continue to recruit high-quality graduate students.

2. Continue superior hands-on training in research and management techniques needed by students to succeed in all phases of aquaculture and fisheries, from research skills to fish farming to fisheries management, product development, and marketing.

3. Continue superior training in oral, written, and computer-based communication skills to make students competitive for top quality professional positions.

4. Provide a continually-updated curriculum that is relevant to the current technology status and issues related to aquaculture and fisheries.

5. Maintain enrollment above the break-even level of 20 students.

6. Maintain an average annual graduation rate above two M.S. students per year to meet the minimum criterion of the Arkansas Department of Higher Education.

7. Ensure that the M.S. Degree program continues to meet criteria established by the U.S. Aquaculture Society, a subchapter of the World Aquaculture Society, and the American Fisheries Society for M.S. programs.

Goal #3. Establish an effective high-quality distance education program

The Aquaculture/Fisheries Department was the first at UAPB to offer distance classes by WebCT and is the only department that teaches a class entirely by CIV. Based on this experience, we feel that we still do not know enough to set up a quality distance education program. Thus, the Center will form a committee to address the following goals and develop a distance education plan. The Center will then move toward gaining approval of that plan and implementation. Committee charges will be to…

1. Determine if Internet connections for faculty and prospective *off campus students* are sufficient to teach a high quality interactive course.

2. To determine how to work with UA and UAPB systems to ensure that that students can easily register for the classes, and to ensure that instructors will receive all of the enrollment and contact data in time for the beginning of the semester.

3. To determine what surveys may be needed to assess demand for particular distance classes. The survey would include 2 and 4 year colleges, aquaculture and fisheries organizations, and high schools.

4. To find ways to promote and advertise our classes so that enrollment justifies our effort.

5. To determine what impact distance classes will have on teaching loads and what additional faculty will be needed for distance classes that we provide.

6. To accurately assess total costs (salaries, technology, and administration) associated with providing distance classes.

7. To set standards for classes that will ensure adequate student:teacher interaction

8. To determine if proctored tests or other steps will be necessary to ensure that the target student is really taking the class and learning the material.

9. To set standards for the amount of effort and materials required per credit hour.

10. To determine a policy to handle class content dependent on “hands-on” and laboratory experiences.

12. To use the results of the work above to plan and initiate an appropriate distance education program to deliver high quality classes to economically viable numbers of students.

13. To investigate the potential to exchange distance classes with other campuses, such as the Monticello campus.

Goal #4. Develop a Ph.D. program.

Recommendations:

1. Address library constraints

2. Address faculty constraints needed to teach new courses required to be taught within the department.

3. Address constraints related to support courses needed from outside the department.

4. Develop proposal for the program and submit it for required approvals.

5. Investigate and obtain funding streams required to implement a high-quality Ph.D. program.

Excellence in Research

Continue to provide superior, innovative, and effective problem-solving research programs to answer stakeholder-identified issues of the aquaculture sector in Arkansas and of the Arkansas Game and Fish Commission. Maintain a seamless linkage with the extension phase of the Aquaculture/Fisheries Center.

Goal #1. Conduct applied and basic research that provides innovative, new scientific knowledge that can be integrated into on-going or new programs to benefit stakeholders and the scientific community.

Recommendations:

1. Continue to conduct research studies that focus on immediate issues and problems confronting stakeholders.

2. Continue research in fish nutrition, fish health, pond and hatchery management, water quality, farm equipment development, and economics and marketing to provide the knowledge necessary for optimal production of aquatic crops well adapted to the climate and natural resources of Arkansas.

3. Continue research on recreational fishing in the Delta to provide the knowledge necessary for science-based management of Arkansas' aquatic resources.

4. Continue to develop research in the reproductive physiology of commercially important aquatic species and larviculture.

5. Further develop research in development of new products, value-added products, and food safety and quality through filling a food scientist position in the UAPB Center by returning the ARS pass-through funding that has been withheld by ARS.

6. Continue to expand research in marketing aquaculture products.

7. Strengthen the partnership with the ARS unit through development of a 5-year strategic plan for the co-location at UAPB.

Excellence in Extension

Continue to provide superior, innovative, and effective extension programming in support of the rapidly growing aquaculture sector in Arkansas. Maintain a seamless linkage with the research phase of the Aquaculture/Fisheries Center.

Goal #1. Continue to provide scientific, research-based information and technical advice on emerging issues and initiatives of importance to the aquaculture industry.

Recommendations:

1. Extension Specialists will continue to serve as requested on regional and national technical, steering committees, and task forces.

2. Continue to maintain a high level of competency among Extension Specialists through attendance and active participation at national workshops and professional association meetings.

3. Develop an extension program on Aquatic Nuisance Species.

4. Assist the Arkansas State Plan Board to develop a Baitfish Certificate Program.

5. Continue to provide extension support on competitiveness and efficiency issues for U.S. aquaculture to compete with low-priced imported products.

Goal #2. Continue Aquaculture Research Verification Statewide

Recommendations:

1. Evaluate, revise, and improve the implementation of catfish research verification.

2. Continue baitfish research verification

Goal #3. Expand and improve web site delivery of educational programs.

Recommendations:

1. Provide web-based forms, questionnaires, and surveys that may be filled out online by our customers – to increase knowledge of our customers' needs, wants, and satisfaction with our web information.

2. Provide searchable database access to our web customers, allowing them better and faster access to the research-based information they need to evaluate our results and to assist them in making decisions. (Data will be obtained primarily from the research verification program).

3. Maintain and upgrade the farm pond management web site

4. Continue to add new materials (printed, Power Point, photographs, and video) to web site.

Goal #4. Provide statewide fish health services

Recommendations:

1. Continue to provide high-quality fish health and water quality diagnostics support to the aquaculture industry in the state.

2. Construct and open new diagnostics laboratories in Lonoke and Lake Village.

3. Expand the biosecurity initiative.

4. Provide fish health inspection and research assistance in support of interstate movements of fish.

Goal #5. Develop plans for aquaculture/fisheries extension

Recommendations:

1. Work with CES agents in planning for aquaculture and fisheries education. Conduct biannual needs surveys.

2. Convene committees, establish priorities, and develop action items.

Goal #6. Develop active program of extension education in youth fishing education.

Recommendations:

1. Improve support to county agents of national fishing curriculum with a mobile fishing trailer.

2. Provide leadership for youth fishing education in Arkansas.

3. Develop educational program on community and urban fishing.

Goal #7. Expand specialist and agent in-service training activities

Recommendations:

1. Expand in-service training programs for county agents.

2. Maintain and update EDUCATOR training for agents.

Goal #8. Continue to provide research-based information and technical advice on management and emerging issues in natural resources for managers, agents, and private land owners.

Recommendations:

1. Continue natural fisheries evaluations and farm pond research.

2. Maintain quality educational resources in pond management, community fishing, and related natural resource areas.

3. Provide leadership in extension education in farm pond management and irrigation reservoirs.

Goal #9. Aquaculture education in high schools

1. Implement the aquaculture education in high schools developed under the previous Plan.

2. Evaluate the feasibility of initiating short courses, such as an Introduction to Aquaculture, for high schools.

3. Develop in-service training programs for high school teachers with aquaculture systems.

Goal #10. Provide science-based information relevant to discussions on policy and regulatory issues to industry representatives and to policy and regulatory issues.

Maintain an Effective Infrastructure

For the Aquaculture/Fisheries Center of Excellence to continue to make improvements in teaching, research, and extension programs, we must maintain a high-caliber faculty, and support staff in addition to continually improving our physical facilities.

Goal #1. Maintain and expand a high-caliber faculty.

Recommendations:

New faculty positions will be required to support the Ph.D. program. Specific position titles will be based on the needs identified in the proposal for the Ph.D. program (see Goal # 4 under Teaching).

Goal #2. Maintain a strong support staff.

Recommendations:

1. Add an assistant manager for the Aquaculture Research Station.

2. Add a mechanic position for the station.

3. Identify position titles that will enable the Center to hire more dependable, reliable crew with a good work ethic.

4. Add a librarian position for the new AFREL library to be developed in Woodard Hall as an extension of the John Brown Watson Memorial Library and identify funding sources to maintain the position at the conclusion of the grant providing the current funding.

Goal #3. Provide quality information technology infrastructure.

Recommendations:

1. Obtain a T1 Internet communications line for the Aquaculture/Fisheries Center allowing our teaching faculty, research and extension personnel fast, reliable access to our email service and the web-based information we need, while allowing frequent, timely transfer of very large data files with other stakeholders, colleagues, institutions, and organizations.

2. Obtain either a wired network communications line, dependable wireless network communications capability, or as a “minimum” a Digital Subscriber Line (DSL)

based web communications from the Aquaculture Research Station to the main campus – providing a direly needed network connection from the Station to the rest of the campus and/or at least a fast Internet connection for the staff and faculty that work in that area.

3. Upgrade current 10Mhz based Aquaculture/Fisheries network backbone architecture to newer 100 Mhz or 1 Ghz based hardware, to relieve existing network congestion and allow faster file transfer, email communications and web-based traffic.

4. Obtain dedicated network server and required supporting software and hardware to set up Aquaculture/Fisheries Center Internet Server, providing local management of our web site, capability to transfer large files (beyond local management of our web site, capability to transfer large files (beyond our email service's capabilities), and to provide web-based video-on-demand service providing information on our teaching, extension and research activities.

5. Obtain one basic (local service) telephone line in Woodard Hall computer support office, in support of laptop communications maintenance.

Goal #5. Secure sources of funding for the following:

Recommendations:

1. A building to house Aquaculture/Fisheries Center personnel that includes adequate classroom, bench and analytical laboratory (these are distinct from and do not duplicate the facilities to be constructed at the Aquaculture Research Station), and office space for all faculty, staff, and students. The current housing, with faculty, staff, and students spread across five different locations is not conducive to the type of interaction and collaboration necessary to fulfill the mission of the Center. The peer review evaluation conducted in 2000 highlighted the need for AFC personnel to be located in one building. Personnel are currently scattered among five different buildings. This creates a need to duplicate secretarial and office support among different buildings and hinders frequent personal interactions among faculty, staff, and students. Additional detail is included in Appendix A. 1.

2. Create a fund to support recruitment expenses, primarily for undergraduate students.

3. Expand the scholarship fund for undergraduate students.

4. Upgrade computers every 4 years and other research equipment as it becomes obsolete and unreliable.

5. Road improvements to primary access road, primary access bridge, and a new road from Hwy. 79.

6. Adequate research laboratory space for each faculty member.

7. Rebuild the older half of the Aquaculture Research Station to allow full use of all ponds in experiments. Currently, the seepage problems that date back to the original construction of the oldest ponds are such that they cannot be used in experiments.

8. Acquire property from the station to Hwy 79.

9. Re-do fencing around the station and re-establish the gate.

Goal #5: Develop a mechanism to provide adequate communications support to the Aquaculture/Fisheries Center

Recommendations:

1. Assign faculty to write an article every other year. With the current number of faculty, this would result in an article to be submitted to the press every other month.

2. Improve contacts with local reporters, free-lance reporters, Delta Farm Press, to actively encourage an increase of press articles related to the Center's research and extension output.

3. Explore other options to identify adequate communications support to improve the output of articles on research and extension output.

Appendix C
Syllabi of Graduate Courses

ADVANCED AQUACULTURE (GAQF 5210)

INSTRUCTOR: Peter Perschbacher

OFFICE: S.J. Parker Agricultural Experiment Station, Rm 107

OFFICE HOURS: 1-3 M,W,TH.,F or by appointment

TELEPHONE: 575-8145

E-MAIL: pperschbacher@uaex.edu

PREREQUISITES: None

DESCRIPTION: Readings, discussion and lectures on aquaculture. The elements and functioning of pond, raceway, cage and RAS systems will be examined. The state of knowledge of the biological, chemical/physical and sociological bases, determinants and limitations of systems and species will be assessed. Special emphasis will be given to systems and species of regional importance. Students will choose a topic to research and report.

OBJECTIVES: At the completion of the class students will:

1) be knowledgeable of current research in key areas of aquaculture, including new species

2) know major aquaculture systems and species worldwide.

3) have an historical perspective on aquaculture

4) have detailed knowledge of culture practices for major freshwater and marine food, bait and ornamental finfish and for major shellfish

5) be an understanding of the use of genetic engineering

6) understand the influence of the legal and regulatory challenges to successful aquaculture production

CONTENT: Analyses and studies of the major biological, chemical, physical and sociological determinants to present level of aquaculture production will be undertaken from the most current literature. To address sociological issues, a variety of sources will be used from technical and popular publications. The acquisition of new information through student research will be encouraged and materially supported.

TIME and PLACE: 12:30-1:45 TTH Rm. 209 Woodward Hall

TEXT/
MATERIALS: No text. Readings will consist of journal articles, book chapters and extension materials which will be continuously updated.

REFERENCES: Census of Aquaculture. 2005. USDA. NAAS

GRADING: (See attached score sheet)

	Points
Written synopses of weekly readings	50
Crop Report lecture	25
Final	20
Class participation	5
Total	100

(A=90-100, B=80-89, C=70-79, D=60-69, F=below 60)

WEEKLY TOPICS:

Jan. 12	Introduction/History
Jan. 19	New culture species
Jan. 26	Major culture species worldwide
Feb. 2	Major systems worldwide
Feb. 9	Finfish culture for food
Feb. 16	Finfish culture for bait
Feb. 23	Finfish culture for ornamental purposes
Mar. 2	Shellfish culture
Mar. 9	Crop Reports
Mar. 16	Crop Reports
Mar. 23	Spring Break
Mar. 30	Genetic engineering
Apr. 6	Regulatory and political constraints

Apr. 13 Student lectures

Apr. 20 Student lectures

Apr. 27 Day at commercial farm (scheduling TBA)

ATTENDANCE:
The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.

When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

Following 3 unexcused absences, the class participation points will be lost.

STUDENTS WITH DISABILITIES: It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veteran Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

INSTRUCTIONAL STRATEGIES: Readings from latest publications in the topic area to be covered are assigned and reviewed and discussed. Students will lead the discussions. Lectures accompany the topics where needed to complete the state of art coverage. Each student will choose a topic to research and present. Some group functioning will be required to address assignments on given topics requiring analysis of recent data (prepublication).

TEACHING MODELS: The interactive learning process is the model used, based on multimedia information and experience. Student self-study is the essential component in the readings required. Learning by group process is also key, as well as hands on approach to critical thinking skills with data and research.

Score Sheet

	Points
I. Synopses	
A. Ten synopses covering major points and concepts	50
II. Crop Report Lecture	
A. Visual aids legible and useful	5
B Material comprehensive, well organized and introduced, and within time allotment	15
C. Poised, dressed professionally, clear voice, questions stimulated	5
III.. Final	
A. Correct, thorough and referenced to material covered	20
IV. Class Participation	
A. Present and participating in discussions, with less than 3 unexcused absences	5
Total	100

AQUACULTURE ECONOMICS
GAQF 5322

Instructor:	Dr. Carole Engle	**Office Hours:**	Monday 3:00 – 5:00 p.m.
Office:	Woodard 257		Friday 1:00 – 4:00 p.m.
Telephone:	(870) 575-8523 – Office	**Secretary:**	Mrs. A. Cobbs
	(870) 489-4259 – Cell	**Class Time:**	TBA
	(870) 879-3578 – Home	**E-mail**	cengle@uaex.edu

TEXTBOOK: There is no textbook that adequately covers both the critical theory and real world examples of aquaculture in the depth that is necessary for good understanding of the material of this class. The majority of the reading materials will be posted on the Network Neighborhood. The remaining readings will be handed out in class at least one week in advance of covering this material.

The concepts presented in each unit will be reinforced through examination of a synopsis of the economics of producing a particular type of aquaculture product.

CLASS STRUCTURE: You are urged to read the assignments prior to arriving in class. Class time will be spent in discussion of the reading material, on problem-solving exercises related to the issues covered in the readings, and on application of the information to analyses that you will develop in the laboratories.

COURSE OBJECTIVES

1. To calculate break-even costs of production from an enterprise budget, net worth from a balance sheet, net farm income from an income statement, and net cash balance from a cash flow budget.
2. To identify profit-maximizing levels of production.
3. To identify sources and extent of economies of scale across farm sizes.
4. To estimate profit levels when elements of risk are explicitly accounted for.
5. To develop a complete business plan for proposed aquaculture business and correctly assess its feasibility.
6. To analyze long-term investment decisions.
7. To develop amortization schedules for aquaculture loans.
8. To use mathematical programming models to identify profit-maximizing management plans.

9. To identify the major regulations that affect the economics of aquaculture and to list the potential economic effects of each.

COURSE OUTLINE

I. Budget Analyses in Aquaculture

Enterprise budgets are the basic tools to estimate general profit levels in aquaculture. Aquaculturists need to be able to understand and interpret enterprise budgets. The synopsis that will be covered in this unit will be: Tilapia Economics.

II. Financial Analyses in Aquaculture

Balance sheets, and income statements are the basic tools of financial analysis. Aquaculturists need to be able to understand and interpret balance sheet, and income statements. The synopsis that will be covered in this unit will be: Catfish Economics.

III. Cash Flow Analysis in Aquaculture

Cash flow budgets are the basic tool of cash flow analysis and management based on cash flow. Aquaculturists need to be able to develop and interpret cash flow budgets and use them as a basis for farm decision making. The synopsis that will be covered in this unit will be: Shrimp Economics.

IV. Fundamental Economics Relationships

This unit will present the concept of production functions, the three stages of production and where profit-maximizing production levels occur. The synopsis to be presented in this unit is: Catfish, Profit-Maximization.

V. Economies of Scale

One of the most important economic concepts for aquaculture is that of economies of scale. Economies of scale dictate levels of costs of production and selection of profitable market channels. The synopsis to be studied in this unit is: Salmon Economies of Scale.

VI. Risk Analysis

Yields, prices, and interest rates vary over time and subject farmers to risk. Profit estimates that explicitly account for risk are more realistic. The synopsis that will be covered in this unit will be: Risk Analysis.

VII. Economic Feasibility and Business Plan Development

It is critical for the student to understand how to assess and interpret the feasibility of aquaculture businesses. This unit will pull together and integrate the various analyses that have been discussed to date. Student laboratory analyses will serve as the basis for class discussions in this unit. The synopsis that will be covered in this unit is: Tilapia Production Economics in RAS.

VIII. Investment Analysis

Net Present Value and Internal Rate of Return are the basic tools of investment analysis. Aquaculturists need to be able to conduct investment analyses, interpret them, and use results to make appropriate decisions. The synopsis to be studied in this unit is: Pacific Threadfin. Hatcheries.

IX. Lending and Loan Management in Aquaculture

Access to and use of credit in aquaculture is vital to aquaculture businesses. Aquaculturists need to understand loan amortization and management as well as sources of credit and lending requirements. The synopsis to be covered is: Catfish Lending and Loans.

X. Mathematical Programming and Maximizing Profits on Aquaculture Farms

The synopsis that will be covered in this unit is: Shrimp Modeling and Management.

XI. The Effect of Economics and Marketing of Aquaculture Effluents

There has been an increasing amount of regulations that affect the profitability of aquaculture businesses. Aquaculturists need to be conversant with these issues. The Asian carp conflict, FDA, HACCP programs for aquaculture, the new country-of-origin labeling laws, the EPA and the status of its Effluent Limitation Guidelines evaluation of aquaculture, producer quality assurance programs and Best Management Practices will be discussed and analyzed. The synopsis to be covered in this unit is: Trout Production Economics.

XII. Asian Carps and Exotics

The synopsis that will be covered in this unit is: Hybrid Striped Bass.

DISCUSSION PAPER AND REVIEW

1. Each student will develop a discussion paper on an economics problem that is of current importance to some segment of aquaculture. The student will carefully compile a summary of the research base relevant to this issue and develop a series of recommendations for strategies to alleviate the current economic problem. Recommendations must be research-based, justified logically, and be based on economic theory.

2. Each student will review the discussion paper and recommendations and prepare a written analysis of it. The student will question the author of the discussion paper orally in class and will render an opinion as to the overall feasibility of the recommendations.

TEACHING MODEL

Basic information will be presented in the reading materials for this course. Class time will be spent discussing the material, working on solving problems related to the reading materials, presentations of real-world examples of the concepts in the readings, and active discussion of current events in aquaculture economics, based on the concepts presented in the reading materials.

INSTRUCTIONAL STRATEGIES

Students will have the information presented in the reading materials reinforced in the classroom through active discussion of applications, and solving current, real-world problems using the materials in the readings.

GRADING

Activity graded	Maximum points possible
Exam 1	100
Exam 2	100
Exam 3	100
Final exam	100
Business loan proposal	
Enterprise budget	25
Partial budget	15
Balance sheet	10
Income statement	10
Cash Flow Budget	20
Loan amortization and analysis	20
Investment Analysis	20
Economics of Scale Analysis	20
Spreadsheet risk analysis	20
Mathematical programming	30
Discussion paper	100
Review of discussion paper	50
TOTAL POINTS POSSIBLE	765*
Grade	
A	688 – 765
B	612 – 687
C	535 – 611
D	459 – 534
F	<459

***Students are expected to adhere rigidly to the due dates for each activity as outlined in the attached list of due dates. For each day an activity is late, 10% of the possible points will be docked. This will be automatic and there will be no discussion.**

ATTENDANCE

Attendance will be taken in class daily. You are expected to attend **EVERY** class. Roll will be taken at the beginning of each class. Students entering the classroom after the lecture has begun will be marked absent. After three (3) unexcused absences, your advisor will be notified in writing. After six (6) unexcused absences, you will be advised to withdraw from the class. You will have missed too much material to do well.

EXTRA HELP

I am available for extra help during office hours, by appointment, and any time that I am in my office. However, it is best to make an appointment if you need to see me. If you do not understand something after reading the materials and listening to my lecture, come see me. It is up to you to keep up and you must bring your questions to me.

ATTENDANCE AT EXAMS

Attendance at exams is mandatory. **I DO NOT GIVE MAKE-UP EXAMS.** In the event of an extreme emergency that prevents a student from attending an exam, I will weight the comprehensive final exam to account for it. Students who miss regular exams usually have lower grades than others.

INSTRUCTOR ATTENDANCE

I want to be in class with you and help you to learn all that you can about the economics and marketing of aquaculture. I have devoted my entire professional career to this area because I believe it to be one of the most fundamental and critical aspects of aquaculture, at least if there are to be viable aquaculture businesses anywhere in the world. I want to spend time discussing these issues with you this semester.

YOU WILL GET YOUR MONEY'S WORTH OUT OF THIS CLASS!!! No class will be canceled. When I must be out of town, I will schedule field trips, guest speakers, in-class projects, and exams. You will hear of what I learn throughout these trips and my involvement in these activities means that I know the very latest of what is going on with these issues and how it may impact the economics of aquaculture. You need to plan to be at each and every class because there will always be much to do there, even when I am out of town.

CHEATING

Cheating will not be tolerated. Cheating includes copying someone else's homework, using "cheat sheets" in class, looking at someone else's answers during a quiz or an exam, etc. Anyone caught cheating will receive a "0" on that exam, quiz, or paper.

STUDENTS WITH DISABILITIES

It is the policy of the University of Arkansas at Pine Bluff to accommodate students with disabilities, pursuant to federal and state law. Any disabled student who needs accommodation, such as special arrangements for seating or transportation, should inform the instructor at the beginning of the course. The Chair of the Department offering this course is also available to assist with accommodations. Disabled students are also encouraged to contact Michael Washington in Caldwell Hall, Room 205, phone: 870 575-8293, e-mail: eashington_m@uapb.edu.

INSTRUCTIONAL RESOURCES

Unit	Reading Assignment
I	Engle, C. R. 1998. Annual costs and returns of raising bighead carp stocked in fertilized earthen ponds. FSA 9079. Arkansas Cooperative Extension Program, University of Arkansas at Pine Bluff
	Engle, C. R. 1998. Annual costs and returns of raising bighead carp in commercial catfish ponds. Cooperative Extension Program Fact Sheet FSA 9078. University of Arkansas at Pine Bluff, Arkansas
	Tilapia Training Manual
II	Kay, R. D. and W. M. Edwards. 1994. Farm Management. McGraw-Hill, New York. Pp. 139-156; 159-169; 193-210.
	Engle 2005 Budgets
	Tilapia Manual, Shrimp Manual
III	Kay and Edwards Tilapia Shrimp Manuals
IV	Kay & Edwards
V	Engle 2005 Budgets
VI	Valderrama, D. and C. R. Engle. Risk analysis of shrimp farming in Honduras
VII	Lasordo and Westerman. 1994. An analysis of biological, economic and engineering factors affecting the cost of production in recirculating aquaculture systems.
	Lutz, G. 2000. Production economics and potential competitive dynamics of commercial tilapia culture in the Americas
	Engle, C. and N. Stone. 1997. Developing Business Proposals for Aquaculture Loans. Southern Regional Aquaculture Center Publication No.381, Stoneville, Mississippi
VIII	Kay and Edwards, Tilapia Manual. Shrimp Manual
IX	Barry, Hopkins. Trout effluents paper. HSB effluents. Paper. Shrimp effluents paper.
X	Appendix from Diego’s thesis
XI	Engle, C. R. and Valderrama. 2002. Economics of environmental impacts of U. S. aquaculture.
XII	Mitchell, A. J. and A. Kelly. The public sector role in the establishment of grass carp in the United States
	HSB/Black carp paper.

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Bjorndal, T. 1990. The Economics of Salmon Aquaculture. Blackwell Scientific Publications. Oxford, England. ISBN 0-632-02794-5.

Bush, M. J. and J. L. Anderson. 1993. Northeast Regional Aquaculture Industry Situation and Outlook Report. RI Agric. Experiment Station Pub. No. 2917, Northeast Regional Aquaculture Center/Department of Resource Economics, University of Rhode Island.

Hatch, U. and H. Kinnucan. 1993. Aquaculture Models and Economics. Westview Press, Boulder, CO, ISBN 0-8133-8434-2.

Jolly, C. M. and H. A. Clonts. 1993. Economics of Aquaculture. Food Products Press. Haworth Press, Inc., Binghamton, NY. ISBN 1-56022-020-1.

Meade, J. W. 1989. Aquaculture Management. Van Nortrand Reinhold, NY. ISBN 0-442-20570-8.

Shang, Y. C. 1990. Aquaculture Economics Analysis: An Introduction. The World Aquaculture Society, Baton Rouge, LA ISBN 0-9624529-1-2.

Shaw, S. A. and J. F. Muir. Salmon Economics and Marketing. Timber Press, Portland, OR. ISBN 0-88192-077-0.

LABORATORIES

1. Enterprise Budget ________________
2. Partial Budget ________________
3. Balance Sheet ________________
4. Income Statement ________________
5. Cash Flow Budget ________________
6. Investment Analysis: IRR, NPV, etc. ________________
7. Loan Amortization ________________
8. Risk Analysis ________________
9. Mathematical programming ________________
10. Mathematical programming (cont.) ________________

DISCUSSION PAPER

Learning Objective: The student will learn the details of one currently important economic issue of importance to aquaculture. The student will learn to synthesize research information into a coherent summary and to restrict recommendations to the available research base of knowledge.

Outline of the business loan proposal:

1. Balanced overview of the issue. This section will briefly present the arguments on both sides of the issue.

2. Summary of relevant economic theory.

3. Summary of research relevant to the issues.

4. Conclusions and recommendations.

5. Literature Cited.

Length of Paper: 5-7 pages, excluding Literature Citd

Grading:

Correct grammar, spelling, neatness	5 points
Thoroughness, balance, and objectivity of statement of issue	25 points
Relevance of economic theory selected	15 points
Thoroughness of literature review	25 points
Insightfulness of conclusions	15 points
Logic and degree to which recommendations are consistent with Economic theory and the relevant research base	15 points
TOTAL	100 points

DUE DATE: ______________________________________

Potential Topics:

1. Catfish Bargaining Association and its ability to affect farm prices.
2. Should a fathead minnow farmer raise normals or rosy reds?
3. Should a minnow farmer raise jumbo shiners or crappie minnows?
4. Should a catfish farmer feed every day or every other day with low prices?
5. Use of diuron for off-flavor control in catfish.
6. Use of astaxanthin in salmon farming.
7. Should fish farms switch to automated monitoring systems from night crews with hand-held DO meters?
8. Should Asian carps be listed as injurious under the Lacey Act?
9. Other topics can be selected with approval of the instructor.

Review of Discussion Paper

The student will prepare a written review that discusses the strengths and weaknesses of the discussion paper reviewed and evaluate its overall strengths and weaknesses.

Grading of the Review of the Discussion Paper

Correct grammar, spelling, neatness of the review	5 points
Accuracy of review comments related to the theory and research base Underlying the treatment of the issue	15 points
Depth and level of comprehensiveness of review	10 points
Accuracy of conclusions of the review	5 points
Oral presentation of review	15 points

DUE DATE: ________

Extension Methodology GAQF 5315
Syllabus

Course: Extension Methodology
Instructor: Dr. Richard Poling
Office: Woodard 257
Home Telephone:
E-Mail: rpoling@uaex.edu

Outline

I. Overview of the Land-Grant System
   - Legislative acts creating land grant system
   - History of the Extension Service
   - Mission of the Extension Service
   - 1914 – the world, the people and their needs

II. Extension Educational Delivery
   - System organizational structure
   - Strengths and weaknesses of a national system
   - Community based education
   - Extension methodologies through the ages
     - Result demonstrations
     - Club work
     - Train the trainer
     - Community meetings
     - Methodologies for a new century and new audiences

III. Extension Program Development Process
   - Social action process
   - Role of county advisory committees
   - Balancing local, state and national issues
   - Roles of Extension faculty and staff in the program development process

IV. Understanding community issues and needs
   - Review demographics
   - Mapping problems and solutions
   - The change process

V. Evaluation of community based educational programming
   - Setting benchmarks
   - Establishing objectives and goals
   - Measuring progress
     - Logic model
     - Bennett's Hierarchy

VI. Funding Extension programs
  - Federal budget process
  - State appropriations
  - Farm Bill
  - New sources of funding; program fees, grants, contracts
  - Understanding the competition

VII. Extension in the 21st Century
  - Is there a relevant need?
  - How will it be funded?
  - What will the employees be like?
  - Program delivery in a new century
  - Organizational structure
  - Keys to becoming a successful Extension educator

VIII. Opportunities in Economic Development of Rural Communities
  - Student presentations of final project

ATTENDANCE POLICY

Attendance will be taken in class daily. Penalties for missing class will be assessed in accordance with UAPB policy. There will be no textbook for the course, so class lectures and student discussion will be critical to completing the final project for the course. If you miss a class, it is your responsibility to obtain class notes and assignments. Unannounced quizzes will be given during class period.

GRADING POLICY

Quizzes	10%
Abstracts from reading	25%
Needs assessment	15%
Final project	50%

ABSTRACTS FROM READINGS

Students will be required to read a minimum of <u>five articles weekly</u> selected from the suggested reading list, suggested web sites or references approved by the instructor. Be sure to select a variety of sources for your abstracts. Students should complete a 5” x 8” index card on each reading. **<u>Note card should include: title, author, source of reading and a brief description of the article. They will be due on Mondays of each week.</u>**

NEEDS ASSESSMENT

Students will be presented with a case study on an Arkansas county (Pike County) and will be asked to analyze the needs, collect additional data if necessary and determine if an

Extension Aquaculture program could impact the needs and how. This will be presented in a 3 to 5 page written report.

Complete instructions for the project will be distributed prior to the project being due.

FINAL PROJECT -- DEVELOPMENT OF AN EXTENSION AQUACULTURE PROGRAM

Students will select a demographic area and develop an Extension program in aquaculture. The geographic area can be a single county, multi-county, region, state or multi-state area. It does not have to be in Arkansas. Project must include data collection, justification or program need, utilization of a situational analysis, educational methodologies outlined with a calendar of implementation and evaluation methods selected. Each project will be presented in class. Students should prepare and use visuals in the class presentation.

Project grade

The project will be graded as follows:

50%	Analysis of the need, program design and development
25%	Understanding of Extension program development process
15%	Instructor review of presentation
10%	Peer review of presentation

EXTRA HELP

Instructor will be available for extra help before and after class and by appointment. I will also be available by e-mail and by home telephone listed in the front of syllabus.

Aquaculture Marketing (3 credit hours)
Aquaculture/Fisheries (GAQF) 5323
University of Arkansas at Pine Bluff
Fall semester, 2008

INSTRUCTOR: Dr. Madan M. Dey
Office: Woodard Hall, Rm 221
Office phone: 870-575-8108
Fax: 870-575-4637
E-mail: mdey@uaex.edu

CLASS TIMES: Monday/Wednesday/Friday 11:00-11:50am in Woodard Hall, Rm 257
Turn cell phones and pagers off during ***all*** class activities.

OFFICE HOURS: 1:00pm-3:00pm, Monday/Tuesday/Wednesday

Other hours by appointment. Feel free to email or call me anytime. If I am unavailable, I will return your call as soon as possible provided you let me know when/where you can be reached.

PREREQUISITE: None

TEXTBOOK:

Hall Varian. 2006. Intermediate Microeconomics: A Modern Approach. Seventh Edition. W.W Norton & Company

Engle, C. R. and K. Quagrainie. 2006. The Aquaculture Marketing Handbook. Iowa State University Press, Ames. Iowa.

COURSE DESCRIPTION: Aquaculturists need to understand how to develop a marketing plan and interpret results from marketing research. The course will cover key marketing concepts, functions, channels, and strategies. Though the examples will be focused on the aquaculture industry, the course is equally appropriate for natural fisheries.

CLASS STRUCTURE: You are urged to read the assignments prior to arriving in class. Class time will be spent in discussion of the reading material, on problem-solving exercises related to the issues covered in the readings, and on application of the information to analyses that will be assigned to you.

COURSE OBJECTIVES

1. To familiarize basic concepts of theory of consumer behavior and markets as related to seafood.

2. To explain the difference between shifts along demand curve and shifts in demand.

3. To describe recent seafood market trends.

4. To describe the structure, margins, volumes, and product forms relative to major marketing channels for seafood, including: direct sales, brokers, food service distributors, and processors.

5. To compare and contrast effectiveness of generic advertising programs, marketing cooperatives, and farmers' bargaining groups in terms of market development and pricing policies for aquaculture products.

6. To apply key marketing concepts to aquaculture.

7. To develop a marketing strategy and plan that identifies appropriate market segments and pricing mechanisms for aquaculture products.

8. To list and compare the results of international trade disputes involving aquaculture industries over the past decade.

9. To familiarize with the application of quantitative methods to seafood marketing problems.

TECHNOLOGY INTEGRATION: Majority of the reading assignments and lecture notes will be posted on the Network Neighborhood. Some handouts, exercises, and other materials for this course will be distributed through e-mail. The remaining readings will be handed out in class at least one week in advance of covering this material. You must provide a working email address that you check regularly. If you change your email address during the semester, please provide the new address promptly.

DIVERSITY INTEGRATION: This course has been designed specifically for students from the Aquaculture/Fisheries Department with no prior background in economics and marketing. The first part of the course is a review of undergrad level microeconomics (particularly consumer theory and markets) at a faster pace that will prepare the students to proceed to advanced economics and marketing issues. GAQF 5322 offered by Dr Engle provides a review of producer theory.

COURSE OUTLINE

Part 1: Introduction

XIII. Overview of the Course and Seafood Markets Worldwide

This unit will give a) a brief overview of the course, and b) establish the global nature of seafood markets and provide an overview of characteristics and trends. The student of aquaculture needs to understand that aquaculture products must complete successfully in the global seafood market.

Part 2: Review of Consumer Theory and Markets

This part will review at a faster pace the fundamental microeconomic concepts of consumer preference, utility, demand, supply, and price discovery mechanisms of the market. This review of microeconomic principles will allow students unfamiliar with economics to apply these concepts in seafood markets and marketing later in the course.

XIV. Budget Constraint and Preferences

This unit will examine how to describe what a consumer can afford and how the consumer determines what is best.

XV. Utility, Choice and Demand

This unit will discuss the basic model of consumer choice and examine how the optimal choices of consumers vary as prices and income change.

XVI. Market Demand, Industry Supply and Equilibrium

This unit will discuss how to use market demand and industry supply curves to determine the equilibrium market price.

XVII. Forms of Market Structure: Pure Competition, Monopoly and Oligopoly

In a competitive market there are many farms selling an identical product. In a monopolized market there is only one farm selling a given product. In reality most industries are somewhat in between these two extremes. This unit will discuss various market structures.

EXAM 1

Part 3: Aquaculture Marketing and Market Structure

This part deals with fundamental principles of marketing and industrial organization, with focus on aquaculture markets.

XVIII. Aquaculture Marketing Concepts

This unit will help students understand key marketing concepts. Marketing functions will be presented and discussed, supply chain management, pricing systems, the marketing bill and market power will be presented.

XIX. Aquaculture Growers and Their Marketing Choices

Aquaculture products present some unusual supply characteristics and challenges that have implications for successful marketing strategies.

XX. Aquaculture Market Channels

Aquaculture products can move through a complex food distribution network. Aquaculturists must understand the supply chain for their products to develop successful market plans and strategies.

XXI. Marketing by Farmer Groups

Aquaculture marketing initiatives will be contrasted with those of other farm commodity groups. Aquaculturists need to understand what has been attempted and the outcomes.

XXII. Developing Marketing Strategies

This unit will develop a framework and methods to develop market plans based on well-conceived market strategies. Market segmentation, product and strategy formulation for products with existing demand will be contrasted with those for new products and species. Commodity and niche markets will be contrasted. Pricing systems will be discussed. Successful aquaculture businesses are those that develop insightful marketing strategies.

EXAM 2

XXIII. Food Safety Standards and Regulatory Measures

Food safety regulations were introduced in the (now) industrialized countries (including USA) in the early years of the 20th century. This unit discusses various food safety standards and regulations.

XXIV. The International Market for Seafood and Aquaculture Products

Recent trade disputes related to aquaculture products will be discussed. These have been the largest issues in the industry and students should be able to discuss them intelligently.

<u>Part 4: Application of quantitative methods to seafood marketing problems.</u>

The objective of this part is to bring the students up to speed on current work and provide a basic overview of the elements and challenges of seafood market research.

XXV. Overview of Marketing Research Methodologies

It is essential that marketing research be conducted appropriately. This unit will look at the fundamentals of seafood market research.

XXVI. Demand Models
During the last two decades, there has been an explosion in the number of studies of the demand structure for seafood markets. The purpose of this unit is to review fish demand studies, focusing on the method used, the information that is obtained, and how this information varies with the approach used.

XXVII. Hedonic Price Models
Hedonic price theory is based on the hypothesis that goods are valued for their utility-bearing attributes. This unit will review recent studies on seafood hedonic price models.

XXVIII. Choice Models/Conjoint Analysis
Choice models are an alternative approach when market information related to a multi-attribute product is not available. This unit will review recent examples of this type of study applied to seafood industry.

XXIX. Market Integration Studies
Researchers use co-integration to determine whether prices for different products move together over time. This unit will review recent market integration studies with respect to seafood.

EXAM 3

XXX. Use of Scanner Data in Seafood Market Research
The recent availability of commercial scanner data allows significant advances in understanding food marketing. The strength of scanner data is that it is evidence of actual market choices, allowing researchers to use 'revealed preference' data (such as from past purchases at the retail level). But, so far, very few studies of seafood have utilized scanner data. This unit will discuss the potential for using national scanner data in seafood marketing research, particularly to address issues such as market trends, demand for different seafood products, and changing consumer buying patterns.

FINAL EXAM (COMPREHENSIVE)

PROJECTS

Each student will develop two projects in this class.

3. Term Paper: Each student will prepare a review paper (maximum 15 typed written pages without references) on the market for a key aquaculture product. The student will present (10-12 minutes long) a summary of the paper in class.

4. Critique of a scholarly Research Paper: Each student will prepare a critical evaluation of an empirical seafood demand or marketing paper previously appearing in a peer reviewed journal. Students must consult with the instructor prior to selecting and finalizing the critique paper.

GRADING

This is a graduate level course and students should approach their work in a professional manner. **Course assignments must be complete and turned in during class on assigned dates.** Final grades will be based on the total points accumulated from all exercises. Grades will be assigned according to the following schedule:

Activity graded	Maximum points possible
Exam 1	100
Exam 2	100
Exam 3	100
Final exam	130
Term Paper	
Depth and level of comprehensiveness	30
Critical assessment of the current situation	25
Application of economics/marketing concepts	25
Correct grammar and spelling	10
Oral Presentation (clarity and succinctness)	10
Critique	
Evaluation of practical importance	25
Evaluation of analytical and empirical framework used	25
Evaluation of originality and depth of analysis	25
Evaluation of clarity of presentation	25
Quizzes/Class participation	50
TOTAL POINTS POSSIBLE	680
Grade	
A	612 – 680
B	544 – 611
C	476 – 543
D	408 – 475
F	<408

ATTENDANCE AT EXAMS

Attendance at exams is mandatory. **THERE WILL BE NO MAKE-UP EXAMS**. In the event of an extreme emergency that prevents a student from attending an exam, I will weight the comprehensive final exam to account for it.

STUDENTS WITH DISABILITY POLICIES

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veteran Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

CLASS ATTENDANCE POLICY:

The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

1. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

2. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

3. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.

4. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

5. An additional three (3) unexcused absences beyond those in #4 will result in an automatic "F" awarded to that student in the class.

INSTRUCTIONAL RESOURCES

UNIT	READING ASSIGNMENTS
I	Engle and Quagraine, Ch 1; FAO (2007)-SOFIA, Part 1; Delgado *et al.* 2003, Ch 2 and 4
II	Varian, Chapters 1-3.
III	Varian, Chapters 4-6
IV	Varian, Chapters 15 and 16, Engle and Quagraine, Ch 2
V	Varian, Chapters 22, 24 and 27; Bouras and Engle (2007)
VI	Engle and Quagraine, Ch 3
VII	Engle and Quagraine, Ch 4
VIII	Engle and Quagraine, Ch 6 and 8
IX	Engle and Quagraine, Ch 7
X	Engle and Quagraine, Ch 12
XI	Josling *et al*. (2004), ch. 3, 5 and 6; Dey *et al.* (2005)
XII	Engle and Quagraine, Ch 12; Josling *et al*. (2004). Chapter 7.
XIII	Anderson (2003), Ch 7; Engle and Quagraine, Ch 12; Kinnucan *et al.* (2003) ; Kinnucan and Wessells, (1997)
XIV	Asche *et al.* (2007); Dey *et al.* (2008) ; Garcia *et al.* (2005)
XV	Roheim *et al.* (2007); Kristofersson and Rickertsen (2007)
XVI	Harrison *et al.* (2002); Jaffry *et al.* (2004)
XVII	Asche *et al.* (2007) ; Kinnucan *et al.* (2003) ; Quagrainie and Engle. (2002)
XVIII	Roheim *et al.* (2007); Chidmi and Lopez (2007); Lee *et al.* (2005)

BIOLIOGRAPHY/READING LIST

Readings are selected to expose students to theme, concepts and tools in aquaculture market analysis. These readings (except for a few seminal articles, all materials are recently published) are intended to build upon and enhance student's theoretical knowledge, provide expose to the research process, illustrate application of theory, and to build critical thinking skills.

Anderson, J.L. 2003. *The International Seafood Trade*, CRC Press LLC, Boca Raton, FL and Woodhead Publishing Ltd., Cambridge, England, 222 pp.

Asche, F., T. Bjorndal and D. Gordon. 2007. Studies in the demand structure for fish and seafood products, in Weintraub, A., Romero, C., Bjorndal, T. and Epstein, R. (eds), *Handbook of Operations Research in Natural Resources*. Springer, pp 295-314

Bouras, D. and C. R. Engle. 2007. Assessing oligopoly and oligopsony power in the U.S. catfish industry. Journal of Agribusiness, 25(1): 47-57

Chidmi, B. and R.A. Lopez. 2007. Brand-Supermarket Demand for Breakfast Cereals and Retail Competition. *American Journal of Agricultural Economics,* 89:324-337.

Delgado, C.L., Wada, N., Rosegrant, M.W., Meijer, S. & Ahmed, M. 2003. *Fish to 2020: supply and demand in changing global markets*. International Food Policy Research Institute and WorldFish CenterTechnical Report 62.

Dey M. M**.,** M A Rab, A Kumar and A Nisapa, and M Ahmed. 2005. Food safety standard and regulatory measures: implications for selected fish exporting Asian countries. *Aquaculture Economics and Management*, 9 (1&2): 217-236.

Dey M.M. and Y.T. Garcia with Kumar P, Piumsombun S, Haque MS, Li L, Radam A, Senaratne A, Khiem NT, Koeshendrajana S. 2008. Demand for fish in Asia: A cross-country analysis. *The Australian Journal of Agricultural and Resource Economics*, 51: 321–338

Engle, C. R. and K. Quagrainie. 2005. *The Aquaculture Marketing Handbook.* Iowa State Press, Ames, Iowa.

FAO. 2007. *The State of World Fisheries and Aquaculture:2006*. Food and Agriculture Organization of the United Nations, Rome.

Garcia, Y., M. M. Dey and S. Navarez. 2005. Demand for fish in the Philippines: a disaggregated analysis. *Aquaculture Economics and Management*, vol. 9, no. 1-2, pp. 141-68.

Harrison, R. W., T. Stringer, and W. Prinyawiwatkul. 2002. An Analysis of Consumer Preferences for Value-Added Seafood Products Derived from Crawfish**.** *Agricultural and Resource Economics Review* 31(2): 157-170

Jaffry S., J. H. Pickering, Y. Ghulam, D. Whitmarsh, and P. Wattage**.** 2004. Consumer choices for quality and sustainability labelled seafood products in the UK**.** *Food Policy*, 29(3): 215-228

Josling, T., D. Roberts and D. Orden. 2004. *Food regulation and trade: towards a safe and open global system*. Institute for International Economies, Washington, D.C.

Kinnucan,H., F. Asche, Ø. Myrland, and C. Roheim. 2003. Advances in Economics of Marketing and Implications for Aquaculture Development. *Aquaculture Economics and Management,* 7:35-53.

Kinnucan, H.W. and C.R. Wessells. 1997. Marketing Research Paradigms for aquaculture. *Aquaculture Economics and Management,* 1(1):73-86.

Kristofersson, D. and K. Rickertsen. 2007. Hedonic Price Models for Dynamic Markets. *Oxford Bulletin of Economics and Statistics*, 69(3):387-412.

Lem A. 2006. WTO trade rules with an update on the Doha round of negotiations and a short reference to antidumping actions, pp 41-52. In P. Leung, C. Engle (eds). *Shrimp Farming, Economics and Trade*. Blackwell Publishing. 335 pp.

Li, L., H.F. Carman, and R.J. Sexton. 2005. Grocery retailer pricing behavior for California avocados with implication for industry promotion strategies. Department of Agricultural and Resources Economics, University of f California Davis, Davis, California.

Quagrainie, K. K., and C.R. Engle. 2002. Analysis of catfish pricing and market dynamics: The role of imported catfish. *Journal of the World Aquaculture Society*, 334: 389-397.

Roheim, C., L. Gardiner and F. Asche. 2007. Value of Brands and Other Attributes: Hedonic Analysis of Retail Frozen Fish in the UK. *Marine Resource Economics*, 22(3):239-53.

Varian, H. 2006. *Intermediate Microeconomics: A Modern Approach*. Seventh Edition. W.W Norton & Company.

Wessells, C.R. and J.L. Anderson. 1992. Innovations and Progress in Seafood Demand and Market Analysis. *Marine Resource Economics*, 7(4):209-228.

Aquatic Animal Nutrition
GAQF 5336

Instructor: Dr. Rebecca Lochmann

Office address: 106 S.J. Parker Agricultural Research Center.
Office phone # 870-575-8124
Fax # 870-575-4639
Secretary's phone # 870-575-8528 (Anthony Anderson)
E-mail: rlochmann@uaex.edu

Office hours: Monday (1 - 4 pm) and Wednesday (1- 4 pm) or by appointment. It is best to make an appointment (during scheduled office hours or other times) so that our meeting will be more productive. Request appointments by e-mail or when you see me in class. If I have other meetings that I must attend during my scheduled office hours I will leave a note on my door. I will inform you of out-of-town travel in advance. My secretary will be kept informed of any schedule changes that may affect you.

Prerequisites: B.S. Degree

Course Content: Aquatic animal nutrition teaches the terminology and concepts needed to understand what nutrients are, and how they are metabolized in aquatic animals- differences in nutrition of aquatic and terrestrial species are emphasized. The concept of nutrient essentiality is introduced and discussed with relevance to different nutrients in different aquatic animals. Practical diet development based on the nutrient requirements of different species is discussed. Class assignments frequently draw on real case-study events that focus on fish nutrition in industrial settings. The impact of issues that affect this field of study (e.g., environmental issues, animal welfare issues) also will be studied.

Course Objectives: 1.) Students must be able to define and give examples of all nutrient groups; 2) Students must know the function of all nutrient groups and which are essential (dietarily and/or metabolically) for different species; 3) Students must know how nutrients are digested, absorbed, and converted into energy (catabolism); they must also know how nutrients are used to synthesize other products (anabolism); 4) Students must be aware of the current issues that constrain both basic and applied studies in fish nutrition, and be able to design experiments with these in mind; 5) Students must be aware of fish nutrition issues important to the aquaculture industry and of methods used to deal with them.

Attainment of objectives will be measured by student performance on tests and exercises. An objective is considered achieved when the student scores 80% or higher on the test or exercise that addresses it.

Instructional Strategies include lecture, case studies, in-class written exercises to enhance critical-thinking skills and group discussions. Lectures are a combination of written exams and group oral exams to address different learning styles. Nutritional principles will be demonstrated by reference to on-going nutrition experiments, as appropriate.

Teaching Models: A combination of individual and group exercises, written and oral, will be used to introduce and reinforce class material.

Instructional Resources:

Textbook (**required**) : Nutrient Requirements of Fish. 1993. National Research Council (NRC).
Bring this book to class with you daily. This is a classic reference that is still pertinent for the needs of this class. Updated material will be given in lecture to supplement the text.

Graduate students will also be given supplemental reading assignments from the primary literature (journals), particularly papers that review specific areas of fish nutrition.

Additional reading (optional) for this class:

Title	Authors or Editors
Nutrition and Feeding of Fish - Second edition.	Tom Lovell
Nutrition and Fish Health	Lim and Webster, eds.
Fish Nutrition - Second edition	Halver, ed.
Fish Nutrition - Third edition	Halver and Hardy, eds.
Fish Nutrition in Aquaculture	De Silva and Anderson
Nutrient Requirements and Feeding of Finfish for Aquaculture	
Nutrition of Pond Fishes	Hepher
Food Intake in Fish	Houlihan, Boujard, & Jobling, eds.

I have all of these books in my office - they are available to look at in SJ Parker - They may be checked out for brief periods (no more than 1 week) - I will keep a record of this in my office.

Also – the Aquaculture/Fisheries policy on handling fish is attached to this syllabus (and on our web site): www.uaex.edu/aqfi/research/guidelines/pdfs/fish_**welfare**_policy2005.pdf.

Handouts: Please date all handouts given in class and keep them organized in a notebook. Test material comes from handouts, class lecture notes and text material.

Bibliography

Fish Nutrition, third edition. 2002. J. E. Halver and R.W. Hardy, editors. Academic Press, New York.

Fish Nutrition in Aquaculture. 1995. S. S. De Silva and T.A. Anderson. Chapman & Hall, London.

Nutrient Requirements and Feeding of Finfish for Aquaculture. 2002. C. Lim and C. Webster, editors. CAB International Publishers, U.K.

Nutrient Requirements of Fish. 1993. National Research Council. National Academy Press, Washington, D.C., USA.

Course Outline/Assignments (reading assignments are in required textbook):

I. Introduction to Nutrition

II. Energy (P. 3 – 6)
Quiz # 1 (oral) - covers topics I & II

III. Macronutrients – Proteins – (Read P. 6 – 12 & handouts)
Test I (written) - covers topics I, II, and III

IV. Macronutrient – Lipids – (Read P. 13 – 14 and handouts)
Quiz # 2 (oral) – covers topic IV

V. Macronutrients – Carbohydrates – (Read P. 15 – 16 and handouts)

Test 2 (written) – covers topics IV and V

VI. Glycolysis, TCA and Electron Transport System (read handouts)

In-class exercise (written) – covers topic VI

VII. Micronutrients - The Vitamins – (Read P. 21 – 32)
Quiz # 3 (oral) – covers topic VII

VIII. Micronutrients - The Minerals – (Read P. 16 – 21)
In-class exercise (written) – covers topic V

IX. Student presentations (Last 1-2 weeks of class)

X. Final Exam – written - comprehensive

Notes: Material for tests, quizzes and in-class exercises come primarily from lecture notes given in class. It is critical to attend class and take notes for good performance in this class.
All reading assignments in the text should be completed before we begin lecture on that topic in class. Graduate students will also be given journal articles to read that give more

detailed information on selected topics. Material from journal articles will also be included on tests.

You may select your own presentation topic (with the approval of the instructor). **A short written paper is required** (5 pages maximum, exclusive of references) in addition to an **oral presentation.** A topic related to your thesis research which focuses on nutrition is suggested. However, any area of particular interest to you will be considered. The written paper is worth 75 points, and the oral presentation is worth 25. Presentations should be 10 to 15 minutes in length and should include some form of graphic display (Powerpoint presentation preferred). Each individual must prepare an abstract on their topic to distribute to class members before their talk. You are expected to cover the key points in your abstract during your presentation. On a separate sheet of paper you should cite the specific references you used for your presentation. Use at least 10 different references for your presentation. **Follow AFS guidelines for authors - specify the journal format you followed.**

Class Grades will be based on:

I. Participation 200 points

This includes performance on oral quizzes (50 points each), pop quizzes (10-15 pts.) and in-class assignments. It also includes attendance which will be taken daily. Students are expected to read the book chapters and any other assigned material corresponding to the lecture material <u>before</u> coming to class. All students should <u>take notes</u> every class period because tests and quizzes come from the notes, your books, and handouts. Use the classroom as a forum for questions and interaction concerning nutrition. **Interested, involved students get more out of their classes and make better grades!**

II. Written exams (Mostly short-answer and essay):

Two written exams- 100 points each. Graduate students have an extra page or two of advanced questions in addition to the questions given to the undergraduates. All questions are mandatory for graduate students.

III. Student presentation - 100 points

IV. **Final Exam - Comprehensive –** 100 points

The total # of possible points for the class is 600.
Grading scale:
90-100% = A (540 - 600 pts)
80-89% = B (480 - 539 pts)
70-79% = C (420 - 479 pts)
60-69% = D (360 – 419 pts)
59% or lower = F (359 pts or less)

Assignments: Basic reading assignments are listed by each class topic. There will be an in-class assignment given on each major nutrient group when the lecture material for that topic is nearly completed. Each nutrient group and other nutrition topic will be covered on one major test (either written or oral worth 50 – 100 points each) plus the Comprehensive Final, at least one pop quiz, and at least one in-class written assignment. Pop quizzes are by definition not announced in advance. They will be short with brief answers and be worth a maximum of 10 points (no more than 4 questions, no more than 1 sentence required for the answer). Pop quizzes are given shortly after new material is introduced, emphasizing the importance of learning new material immediately. When there is evidence that previous material needs more reinforcement (e.g., students tell me they do not understand the material or test scores are low), additional in-class or take-home assignments will be given. In-class exercises either focus on quantitative aspects of nutrition that are not emphasized on tests, or they are case studies that require group interaction and/or synthesis of material from several sections (15-30 points). Take-home exercises may be given to reinforce class material further– these take longer than a regular class session and require more detailed answers (such as creating flash cards for vitamins and minerals, where 10-12 different questions must be answered for each vitamin or mineral).

Oral quiz dates will be announced one week in advance and written test dates, two weeks in advance. Once exam times are announced the student is responsible for mastering the material by the scheduled exam time. **Do not wait until the day of the exam to tell me you don't understand something .** It is not realistic to expect to perform well if you wait until the last minute to start studying. If you are having difficulty with the material come see me, bring it up in class and/or consult a fellow classmate who seems to be doing well.

CLASS ATTENDANCE POLICY

The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

1. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

2. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

3. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents

official documentation of the situation to the teacher. All other absences are unexcused.

4. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

Whether absences are excused or not, it is the student's responsibility to find out what you missed in your absence and to make up the work. Pop quizzes cannot be made up but in the case of excused absences, a substitute exercise may be requested to make up the points. You must request the substitute exercise as soon as you return to school. **The student is responsible for all material and announcements covered in every lecture (including missed lectures).**

Please be on time and do not disrupt the class by talking while I am lecturing or by leaving the classroom unnecessarily (cell phone use is not a necessity). If you have to leave early, please have the courtesy to inform me in advance.

Cheating will not be tolerated in any form - I will report any cheating incident in writing to the Department Chair (Dr. Carole Engle) and the Vice Chancellor for Academic Affairs (Dr. Mary Benjamin) for further action.

STUDENTS WITH DISABILITIES

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veterans Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

Cell phone policy: Turn them off in class. Electronic noises that are not related to class activities are disruptive, as is leaving the classroom to take a call.

Aquaculture/Fisheries Center
Animal Welfare Policy 2005

The faculty, staff, and students of the Aquaculture/Fisheries Center conduct scientific research using living animals and recogni[illegible] that the welfare of those animals is of paramount importance both for ethical reasons a[illegible]ure the quality of research results. In order to insure that animal welfa[illegible]con[illegible]dequately addressed, all research done at the Center adheres to th[illegible]owin[illegible]les.

1) Fish are animals and must be treated [illegible]d re[illegible]

2) While there is significant scientific evi[illegible]ving that [illegible] do not experience pain in the same way as do higher animals, there is [illegible]ient controversy that we will always err on the side of caution by handl[illegible]h as gen[illegible]s possible and by anesthetizing them prior to procedures that would [illegible]ably expe[illegible]d to cause significant pain in a higher animal.

3) Studies will be desig[illegible]d to min[illegible]e trauma to experimenta[illegible]nals [illegible] greatest practical [illegible]

4) [illegible]rate a[illegible] (snakes, turtles, [illegible]mal[illegible]) invading [illegible]imen[illegible]ds wil[illegible]arassed into [illegible]ing the e[illegible]imental [illegible], returned to [illegible]ld, or ki[illegible]d by the most humane [illegible] meth[illegible].

4) [illegible] will be protected from diseas[illegible]ecurity guidelines adminis[illegible]d by the Center OINC committee. In the event that animals show signs of diseases, the Center Fish Disease Laboratory will be consulted and the fish provided with the disease treatments most appropriate to the study and to their potential food animal status. All dead animals will be promptly removed from ponds, tanks or other fish holding containers.

"Well, that should pretty much erase all doubt about whether they are intelligent creatures who feel pain."

5) Environmental conditions will be maintained to provide oxygen levels and water quality consistent with good fish health. In the event that water quality deteriorates below acceptable levels, every practical effort will be made to re-establish acceptable conditions. The nature of these efforts will be chosen based on the study design.

6) When fish are sampled, harvested, or handled, they will be kept submerged as much as possible and tranquilizers, salt, and prophylactic disease treatments used as appropriate to mitigate the effects of stress. Fish will be gradually acclimated to temperature changes.

7) When studies are completed, remaining live animals will be sold for aquaculture or food use, donated to state or federal agencies, or euthanized by an overdose of a labeled fish anesthetic and disposed of according to station policy.

8) When wild fish are sampled they will be handled gently, maintained in suitable containers with sufficient oxygen and water quality, and euthanized with labeled fish anesthetics prior to preservation. If they are to be measured, tagged, or subjected to other procedures prior to live release, the fish will be tranquilized if such treatment significantly decreases trauma experienced by the animals. When wild fish are released, it will be into an appropriate habitat as close to their origin as practical.

9) Electrofishing procedures will be periodically reviewed and equipment updated if necessary to ensure the least harm to fish during sampling procedures. For more details see *Snyder, D. E. 2003. Electrofishing and its harmful effects on fish. Information and Technology Report USGS/BRD/ITR-2003-0002, U. S. Government Printing Office, Denver, CO.*

10) All research will be conducted with all of the permits, licenses, and animal welfare oversight required by state and federal law.

11) For more detailed guidance than that provided by this policy, the American Fisheries Society "Guidelines for the Use of Fishes in Research" (currently at http://www.fisheries.org/html/Public_Affairs/Sound_Science/Guidelines2004.shtm) will be followed. Those desiring additional information on fish welfare may consult this comprehensive review.

Erickson, H. S. 2003. Information resources on fish welfare 1970-2003. Animal Welfare Information Center Resource Series N. 20, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, MD.

Aquatic Animal Nutrition Laboratory
GAQF 5136

Instructor: Dr. Rebecca Lochmann

Office address: 106 S.J. Parker Agricultural Research Center.
Office phone # 870-575-8124
Fax # 870-575-4639
Secretary's phone # Mr. Anthony Anderson 870-575-8528
E-mail: rlochmann@uaex.edu

Lab Hours: Arranged day 1 to fit with student schedules - labs are highly variable in the time they require. The first half of the semester will be focused on learning proximate analysis techniques (described below). The students may also be responsible for conducting a feeding trial as a group.

Office hours: Monday (1 - 4 pm) and Wednesday (1- 4 pm) or by appointment. It is best to make an appointment (during scheduled office hours or other times) so that our meeting will be more productive. Request appointments by e-mail or when you see me in class. If I have other meetings that I must attend during my scheduled office hours I will leave a note on my door. I will inform you of out-of-town travel in advance. My secretary (Anthony Anderson) will be kept informed of any schedule changes (phone # below) that may affect you.

Prerequisites: General Chemisty I (CHEM 1430) and II (CHEM 1440).

Course Content: Students will learn analytical laboratory techniques used in fish nutrition research. They will also conduct a feeding trial or short-term nutrition exercise and analyze the data following standard methods used in this field.

Course Objectives: 1) To learn analytical methods for nutrients in feeds and fish tissues; 2) To perform a fish feeding experiment or short-term exercise as a group to see how scientists collect and analyze data to learn about fish nutrition. Objective 1 will be considered achieved when students obtain accurate and precise analytical results at least 80% of the time. Students must achieve a score of 80% or higher on the written summary of data and interpretation of results they produce from the feeding trial or exercise to meet objective 2.

Instructional Strategies and Teaching Models: This is a hands-on practical learning course. Students will perform laboratory analyses relevant to fish nutrition under the supervision of Dr. R. Lochmann and her staff. Data will be analyzed using descriptive or other types of statistics, depending on the type of data collected. Students will also conduct a feeding trial, perform appropriate analyses, and analyze data using Statview, SAS or other software.

Bibliography and Instructional Resources:

1. Methods for most of the basic analyses you will learn are described in the *Laboratory Manual for Fish Feed Analysis and Fish Nutrition Studies* (by Tom Lovell). This manual is out of print - I will provide you with xeroxed copies of the relevant material. You will be provided with additional literature (journal articles and literature produced by equipment manufacturer's) documenting the basis of the development of some of the methods.

Other resources:

AOAC (Association of Official Analytical Chemists). 1995. Official methods of analysis, 16th edition. AOAC, Arlington, Virginia.

Folch, J., M. Lees, and G. H. Stanley. 1957. A simple method for the isolation and purification of total lipids from animal tissues. Journal of Biological Chemistry 226:497–509.

Also – the Aquaculture/Fisheries policy on handling fish is attached to this syllabus (and on our web site): www.uaex.edu/aqfi/research/guidelines/pdfs/fish_**welfare**_policy2005.pdf.

Assignments:

Laboratory activities will be centered in the fish nutrition lab in the S.J. Parker Agriculture Research center. Students will perform the analyses below following instructions and with supervision. We will also use the wet lab facilities or the fish shop for additional activities. Mr. Harold Phillips will be assisting with most of the lab activities, along with Dr. R. Lochmann and other nutrition lab personnel. Many of the procedures are time-consuming, but not difficult. With careful planning more than one procedure can be performed within the same block of time. The written procedure for each lab will be distributed to each student at least 1 day before the lab. Students must read the lab before coming to class and bring the procedure with them.

The following analytical procedures will be covered:

A. Dry matter
B. Ash (Inorganic matter = minerals)
C. Lipid analysis (Folch extraction)
D. Fatty acid analysis (Gas chromatography)
E. Nitrogen/Protein analysis (Kjeldahl procedure)
F. Fiber analysis (insoluble carbohydrates) - Fiber analyzer

These procedures are standard in many fish nutrition studies. The results provide documentation of the effects of your experimental variables on fish performance (i.e., the effect of your diets). Once you have collected all of the above data, you can calculate the nitrogen-free extract (soluble carbohydrate in your sample). The calculation for nitrogen-free extract is: 100 - [moisture + protein + lipid + fiber + ash]. Soluble carbohydrate is the form that is usable as energy (digestible energy). These analyses collectively give you complete proximate analysis data for your samples.

Grading

Points will be given for lab activities during the learning phase (participation [being here, being on time in accordance with a mutually determined schedule, professional conduct, showing initiative]), data recording, calculations, timely completion of required lab analyses and data sheets. The attendance policy for this class is that students will adhere to the prearranged lab schedule unless the student and instructor agree in advance that an exercise will be done at an alternate time.

The highest number of points possible for the lab is 200. These will be divided as follows:

1. 20 points for participation in <u>each</u> of the analytical procedures (A-E) listed above = 100 total.

2. 50 points for participation in additional lab exercises such as conducting a feeding trial and learning additional analytical procedures.

3. 50 points for a cumulative final examination over all topics covered in the lab.

Grades:
90-100% (180 –200 pts) = A
80-89% (160-178 pts) = B
70-79% (140-158 pts) = C
60-69% (120-138 pts) = D
below 60% (less than 120 pts) = F

CLASS ATTENDANCE POLICY

The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

5. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

6. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

7. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents

official documentation of the situation to the teacher. All other absences are unexcused.

8. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

STUDENTS WITH DISABILITIES

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veterans Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

Aquaculture/Fisheries Center

Animal Welfare Policy 2005

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Erickson, H. S. 2003. Information resources on fish welfare 1970-2003. Animal Welfare Information Center Resource Series N. 20, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, MD.

Course Prefix and Numbers: GAQF 5415
Course Title: Ecology of Fishes
Semester: Spring 2006
Course Schedule: T,Th 9:30pm - 10:45pm Applied Sciences Building 105A
Lab Th 2:00pm - 4:50pm

Instructor: Dr. S. Lochmann
Office: 230 Woodard Hall
Office Phone: 575-8165
Office E-mail: slochmann@uaex.edu
Office Fax: 575-4637
Office Hours: M, W, F 8:30am-10:30am
or by appointment

Textbook: Biology and Ecology of Fishes. 2004 Second Edition. James S. Diana

Prerequisites: none

Credit Hours: 4 hours credit, including two seventy-five minute lectures (T,TH 9:30-10:45 am) and one lab (Th 2:00-5:00 pm) per week. Laboratories will be loosely structured and students should be prepared to put in extra time to complete the exercise.

Course Description: The course investigates the manner in which environmental conditions effect the survival, growth, and biology of individual fish and fish populations. Major aspects of fish biology such as population structure and behavior are integrated with parameters limiting and controlling their outcomes.

Course Content: Students will learn through exams and discussion an understanding of fundamental concepts of ecology including: 1) energy consumption, assimilation, and balance; 2) factors controlling growth and reproduction; 3) the concepts of competition, foraging and predation; 4) fish movements; and 5) various other habitat influences on fish as individuals and populations.

Bibliography: The course will use various books and some primary literature. These will include:

Day, R. A. 1983. How to Write and Publish a Scientific Paper. ISI Press, Philadelphia, Pennsylvania.

Eyewitness: fish. Prod. D. Hutt. Videocassette. BBC Wildvision, BBC Lionheart Television, and Dorling Kindersley Vision, 1994.

Huth, E. J. et al. 1994. Scientific Style and Format: the CBE Manual for Authors, Editors, and Publishers. Cambridge University Press, New York, New York.

Safina, C. 1997. Song for the Blue Ocean: encounters along the World's Coasts and Beneath the Seas. Henry Holt and Company, Inc., New York, New York.

Warmwater Streams, A Resource Worth Protecting. Videocassette.

Instructional Resources: The materials listed in the bibliography and some additional primary literature is available in Dr. Lochmann's office. Please use the sign-out sheet if you take materials from his office.

Course Objectives:

1. Students will be able, without text or notes, write the complete bioenergetics equation, explain all terms, and put specific values to each term for a carnivore, omnivore, and herbivore.
2. Students should be able to explain the relation between metabolic rate and all controlling factors using X-Y diagrams
3. Describe using a graph the relation between growth and ration quality and quantity and temperature.
4. When asked, students will be able to define the Fry Paradigm and give specific examples of lethal controlling, limiting, masking, and directive factors.
5. Without notes, a student should be able to define the Hutchinsonian niche theory and to give specific examples of a fundamental niche and a realized niche.
6. A student should be able to illustrate with a graph three examples of density-dependent processes and three examples of density independent processes governing fish populations
7. Without notes, a student should be able to list the five major hypotheses controlling year class strength in larval fish, attribute those theories to their originator, and give examples supporting those theories and contesting those theories from literature.
8. On an exam, students should be able to give the criteria necessary to identify competition between species and to distinguish between exploitation and interference competition.
9. Without the use of notes, a student should be able to list the five components of a predation sequence and to explain prey choice based on the optimal foraging theory.
10. On a closed-book exam, students should be able to explain the effect of prey refuges on the five steps of the predation sequence.
11. On an exam, students should be able to give the five distinct forms of spacing social behaviors in fish and give a specific fish example of each form.
12. On an exam, students should be able to list at least six major axes of reproductive behavior, to list using correct terminology the endpoints of the axes, and to give specific examples from fish of each type of reproductive behavior.
13. During an exam, without notes, a student should be able to define trophic cascade, to explain the difference between systems with top-down and bottom-up control and to give specific examples of each type of system.
14. Students should be able to explain the difference in fish community structure in small and large isolated and joined lakes using the theory of Island Biogeography

Evaluation: Exams will be made of combinations of true and false, short answer, essay, problem solving, matching, multiple choice, and diagram labelling. Exams are CLOSED BOOK AND NOTES unless otherwise stated by the instructor. Calculators are always permissible and will at times be required. Exams missed due to unexcused absences cannot be made up.

Grading:

Exam 1		100
Exam 2		100
Exam 3		100
Exam 4		100
15 Labs (20 pts each)	300	
Class Participation	100	

A = 720 to 800 pts
B = 640 to 719 pts
C = 560 to 639 pts
D = 480 to 559 pts
F = less than 480 pts (I do not curve grades)

Assignments: Students will write up a laboratory report each week. The report should follow the manuscript style outlined in the "guide to authors" of Transactions of the American Fisheries Society (found at http://afs.allenpress.com/fitr.pdf). Any aspects of style not covered in the guide to authors should follow the CBE Scientific Style and Format guide.

Instructional Strategies: The strategies utilized in this course include (a) Action Learning**,** which involves a combination of action and reflection by a team to solve complex, strategic problems in a real-world organizational setting. Team members apply existing skills and knowledge and create new skills, knowledge, and insights through continuously reflecting on and questioning the problem definition, the collaborative behavior, and the ensuing results; and (b) Interactive Lectures, which involve students in the learning process while providing complete control to the instructor. These activities enable a quick and easy conversion of a passive presentation into an interactive experience. Different types of interactive lectures incorporate built-in quizzes, interspersed tasks, teamwork interludes, and participant control of the presentation.

Teaching Models: We will use the critical thinking model to explore the lessons in this class. The critical thinking model stresses the elements of reasoning (Point of view, purpose of thinking, question at issue, information, interpretation and inference, concepts, assumptions, and implications and consequences). For each reading assignment, try to identify the elements of reasoning and be ready to discuss each element in class each day.

Students with Disabilities: It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

Class Attendance Policy: ATTENDANCE OF LECTURES IS REQUIRED. BE ON TIME. PUNCTUALITY IS A MEASURE OF RESPECT FOR YOUR CLASSMATES AND INSTRUCTOR. The University requires regular class attendance of all students. While attendance and tardiness are primarily student-teacher relationships, the University has a concern in the proper fulfilment of such obligations by the student.

1. At the beginning of each class period, the instructor will take roll and note attendance or non-attendance in the roll book.

2. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

3. An absence is excused when a student is absent from class due to participation in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or when a student is confronted with an extenuating circumstance, such as death in the immediate family, a judicial case, or serious illness., etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.

4. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

5. Students who are consistently absent from class without an excuse will have their final class grade lowered two letter grades.

Class participation is graded. I expect students to be able to discuss material from daily reading assignments. I expect students to present their opinions orally in a coherent fashion and to participate in role playing exercises.
NOTE: The grade on all assignments and the term paper will be reduced by 10% for each business day it is late. You should keep a copy (electronic or hard) of all the assignments till the end of the semester in case the instructor miss-places your work.

Textbook Policy: All students must purchase the text book and bring it to class each day. Students without a textbook in class will lose class participation points for the day.

Laboratory Rules:
1. No food or drinks are allowed in the laboratory during labs.
2. Keep your work area clean. Only books, notebooks, and dichotomous keys should be at your workstation (backpacks, coats, etc. should not clutter your work area).

3. Discard used materials as follows:

Animal parts: into receptacle specifically marked for this purpose.

Broken glass/sharp objects: into receptacle specifically marked for this purpose.

Chemical waste: ask the instructor for specific instructions.

General waste: papers, paper towels, etc. can be discarded into the regular trash bins.

4. Wear gloves when handling specimens. Ask your instructor if you need gloves, or if you have questions about when they should be worn.
5. Be careful when handling glass jars containing preserved specimens. Keep the jars on the lab bench (away from the edge), and report any leakage of preservative to the instructor.
6. Report all injuries to the instructor immediately.
7. Become familiar with the location of first aid kits, fire extinguishers, and eyewash stations.
8. Wash your hands well with warm water and soap before leaving the laboratory.
9. Make sure your work area is clean before you leave lab. The tabletop should be wiped down with a damp sponge, all refuse should be properly disposed of, and chairs or stools should be placed under the lab bench.

Cell phones and pagers: Turn off your cell phones before class. Noisy disruptions are unacceptable as is leaving the classroom to take a call. I will collect cell phones that are used during class.

Week	Month	Date	Lectures		Readings
1	Jan	12	1	Intro and Aquatic Ecosystems	Ch. 1
		14	2	scientific writing	
		14	Lab 1	**respirometry**	
2		19	3	Balanced energy equation	Ch. 2
		21	4	Respiration and Metabolism	Ch. 3
		21	Lab 2	**resp and temp**	
3		26	5	Respiration and Metabolism	Ch. 3
		28	6	Digestion, Defacation and Excretion	Ch. 4
		28	Lab 3	**salinity and resp**	
4	Feb	2	7	Digestion, Defacation and Excretion	Ch. 4
		4		Exam 1	
		4	Lab 4	**BioEnergetics Modeling**	
5		9	8	Energy Influences on Growth	Ch. 5
		11	9	Natural Growth	Ch. 6
		11	Lab 5	**acclimation**	
6		16	10	Natural Growth	Ch. 6
		18	11	BioEnergetics Modeling	Ch. 7
		18	Lab 6		
7		23	12	BioEnergetics Modeling	Ch. 7
		25	13	Fry and Hutchinson	Ch. 8
		25	Lab 7		
8	March	2	14	Density dependence/Critical Period	Ch. 8
		4		Exam 2	
		4	Lab 8		

9		9	15	Competition	Ch. 9
		11	16	Foraging Behavior	Ch. 10
		11	Lab 9		
		16	***SPRING BREAK***	**Spring Break**	
		18	***SPRING BREAK***	**Spring Break**	
		18	***SPRING BREAK***	**Spring Break**	
10		23	17	Foraging in Patches	Ch. 11
		25	18	Predation & Refuges	Ch. 12
		25	Lab 10		
11		30	19	Social Behavior	Ch. 13
	April	1	20	Movements of Predatory Fish	Ch. 14
		1	Lab 11		
12		6	21	Reproductive Behavior & Spawn Migra.	Ch. 15
		8		Exam 3	
		8	Lab 12		
13		13	22	Reproductive Strategies	Ch. 16
		15	23	Trophic Dynamics	Ch. 17
		15	Lab 13		
14		20	24	Larval Fishes: Ecology etc…	Ch. 18
		22	25	Temperature and Fish Distributions	Ch. 19
		22	Lab 14		
15		27	26	Fish Communities in Lakes	Ch 20
		29	27	Fish Communities in Streams	Ch. 21
		29	Lab 15		
16	May	4	28	Coral Reefs	Ch 22
		6		Exam 4	

Engineering and Construction of Aquaculture Facilities I (GAQF 5220)

Nathan Stone 1890 Extension Complex, Rm 134
Phone: 575-8138 (office), 540-7810 (cell), 879-3578 (home) E-mail: nstone@uaex.edu
Class: Applied Sciences 105A

Office Hours

Please stop by any time or e-mail me. Official hours are the hour before each class. **Please see me if you have a problem or conflict** before missing a class or lab, as there will be no make-up exams. I'd like for you to do well in this class. Please do your own work. Academic dishonesty will not be tolerated and will result in a zero on the test or paper. A repeat offense will result in a failing grade (F).

Attendance Policy

Class attendance is highly recommended. As this is a summer course, we will cover a lot of material in each class period. There will be lots of reading – twice normal. Unannounced quizzes will be given in class and lab periods, with no make-ups. If you miss a class, it is your responsibility to obtain the class notes and assignments.

Grading Policy

Exams `	45% (20% mid-term, 25% final)
Quizzes	15%
Laboratory Reports	15%
Notebook	10%
Project	15%

<u>Students with Disabilities</u>
It is the policy of the University of Arkansas at Pine Bluff to accommodate students with disabilities, pursuant to federal and state law. Any disabled student who needs accommodation, for example in eating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The Chair of the Department offering this course is also available to assist with accommodations. Disabled students are also encouraged to contact Mr. Michael Washington in the Brown Infirmary, Room 107, Telephone Number (870) 575-8293. His e-mail is Washington_m@uapb.edu.

<u>Project</u>
Prepare a written report (suggested length of 5-10 pages, exclusive of references) and accompanying 15-20 minute presentation for the class on an earthen pond design, engineering or construction topic. Topics must be approved in advance by the instructor. Relatively narrow topics with considerable detail are desirable. Use pictures, drawings, tables, etc., to illustrate your presentation. Example topics: Water supply and drain systems for earthen ponds, Construction of small earthen ponds for research, Treatment of pond effluents, Soil moisture and compaction.

Project format:

Introduction
Theoretical background and design variables
Comparison of existing types of systems
Experimental, future approaches
References

Project grade:
The project will be graded as follows: 70% - project scientific content, topic development, analysis of topic, references, clarity; 15% - peer review of presentation; and 15% - instructor review of presentation, use of AV, etc.

Notebook

Each student is to place class notes, handouts and other relevant materials in a 3-ring binder / CD for future reference. Notebooks will be graded on completeness and organization. This should be an easy 10% of your grade!

Laboratories

I – Estimating pond area and developing a contour map
(laser level, tape, measuring wheel)
II – Engineering properties of soils (AHTD laboratory, Little Rock)
III – Introduction to Geomatics: use of an enclosed transit to map ponds
IV – Conducting an oxygen transfer test

Laboratory Reports

Due Monday after laboratory, Two page maximum
Format: Introduction, Methods, Results, & Conclusions.

Laboratory Safety
Two laboratories will be held outdoors at the Aquaculture Research station. It will be hot and humid. Wear loose-fitting clothes, a hat, apply sunblock and drink water. A drinking fountain is located in the VAPD building. Remember the safety meeting warnings about heat. Watch for fire ants and snakes. If there is any sign of a thunderstorm, we will suspend the lab and retreat to the VAPD building.

In the aeration laboratory, we will use sodium sulfite. In a few cases, people are highly sensitive to this compound (allergic reaction). Use gloves and safety glasses, and avoid contact with the solution.

We will travel to the Arkansas Highway department soils lab in Little Rock. Seat belts are mandatory and please keep all appendages within the vehicle.

Textbook:
Lawson, T. 1995. Fundamentals of aquacultural engineering. Chapman & Hall, New York, NY.

Reading Materials:
Avault, J. 1996. Fundamentals of aquaculture. AVA Publishing Co, Baton Rouge, LA. Chapters 5 and 6 (Site Selection and Culture Systems, Water Requirements). pp:175-279.

USDA-NRCS, 1997. Ponds- planning, design, construction. United States Department of Agriculture Natural resources Conservation Service Agriculture Handbook Number 590, Washington, DC.

SRAC fact sheets: http://srac.tamu.edu/
#100 Site selection of levee-type fish production ponds
#101 Construction of levee-type ponds for fish production
#102 Watershed fish production ponds site selection and construction.
#104 Repairing fish pond levees
#105 Renovating leaky ponds
#161 Cage culture: site selection and water quality
#162 Cage culture: cage construction and placement
#371 Pond aeration: types and uses of pond aeration equipment
#600 Characterization and management of effluents from aquaculture ponds in the southeastern U.S.

COURSE OUTLINE
Engineering and Construction of Aquaculture Facilities I

Introduction
Review of class purpose, policies, syllabus, and expectations

Site Selection
marketing to environmental considerations

Production Units
earthen ponds
concrete ponds
raceways, tanks, aquaria
cages
recirculating systems

Pond Construction - Levee and watershed
soils, engineering properties, soil testing
site layout
watershed characteristics
construction equipment
earthmoving and compaction

water supply, drain lines
electrical systems
vegetative cover

Water Supply
ground water, wells,
surface water, reservoirs

Aeration
types of aerators
aerator efficiencies

Effluents

Engineering and Construction of Aquaculture Facilities II (GAQF 5221)

Dr. Eric Park, Aquatec, Inc.
Phone: 501/231-8607 E-mail: drericpark@aol.com
Class: Woodard 210 Lecture: Monday, 1-5 p.m.; Lab: Friday 1-5 p.m.
Office Hours: Official hours are the hour after each class.

Attendance Policy

Class attendance is highly recommended. As this is a summer course, we will cover a lot of material in each class period. Unannounced quizzes will be given in class and lab periods, with no make-ups. If you miss a class, it is your responsibility to obtain the class notes and assignments.

Grading Policy

Exams	200 pts (100 pt mid-term, 100 pt final)
Class Participation	160 pts
Project	50 pts
Presentation	50 pts

Project

Prepare a written report (suggested length of 5-10 pages, exclusive of references) and accompanying 15-20 minute presentation for the class on an aquacultural engineering topic related to recirculating systems. Your report will be distributed to classmates for inclusion in their notebooks. Topics must be approved in advance by the instructor. Relatively narrow topics with considerable detail are desirable. Use pictures, drawings, tables, etc., to illustrate your presentation. Example topics:

- Comparison of biofilters for recirculating systems
- Fishing tournament holding systems for largemouth bass
- Mobile display tank systems
- Treatment of recirculating system effluents
- Water garden engineering

Project format:

- Introduction
- Theoretical background and design variables
- Comparison of existing types of systems
- Experimental future approaches
- References

Project grade:

The project will be graded as follows: 65% - project scientific content, topic development, analysis of topic, references, clarity; 35%.

Notebook
Each student is to place class notes, handouts and other relevant materials in a 3-ring binder for future reference. Notebooks will be graded on completeness and organization as part of the class participation grade.

COURSE OUTLINE
Engineering and Construction of Aquaculture Facilities II

Introduction
  Review of class purpose, policies, syllabus, and expectations

Recirculating Systems
  Introduction to recirculating systems
  System design, component options
  Carrying capacity
  Management

Ancillary Facilities
  Hatcheries
  Fry rearing
  Holding/shipping sheets

Pumps and pipes
  Types of pumps
  Pump performance
  Pipe materials
  Pipe friction losses

Aeration and pure oxygen systems
  Blowers, compressors
  LOX (liquid oxygen)

Disinfection
  Ozone
  UV

Electricity
  Effluents from intensive systems

Assigned Textbooks:
Lawson, T. 1995. Fundamentals of aquacultural engineering. Chapman & Hall, New York, NY. Chapters 6-8, 10-12.

Reading Materials:

Petit, J. 1990. Water supply, treatment, and recycling in aquaculture, pp. 63-196 in G. Barnabe, ed., Aquaculture Volume 1. Ellis Horwood Limited, Chichester, England.

Engineering aspects of intensive aquaculture. 1991. Northeast Regional Agricultural Engineering Service, NRAES-49, Cornell University, Ithaca, NY. Articles by Wheaton et al. (pages 1-31), Losordo (page 32-47), Riley (page 131-150), Westers (pages 151-159) and Lee (pages 284-300).

SRAC fact sheets: http://agpublications.tamu/pubs/efish/srac.html/

- #191 Design and construction of degassing units for catfish hatcheries
- #372 Selecting the proper pump
- #373 Piping systems
- #374 Open channel flow in aquaculture
- #375 Powering aquaculture equipment
- #390 Transportation of fish: equipment and guidelines
- #451 Recirculating aquaculture tank production systems: An overview of critical considerations.
- #452 Recirculating aquaculture tank production systems. Management of recirculating systems.
- #453 Recirculating aquaculture tank production systems: Component options.
- #454 Recirculating aquaculture tank production systems: Integrating fish and plant culture.

GAQF 5407: Experimental Design and Analysis

Session: Spring of odd years
Credit hours: 4 hours (two 75 min-lectures/week, one 2 hrs-computer lab/week)
Time: TBA
Location: TBA

Instructor: Dr. Lin Xie
Office: Woodard Hall, Rm 228
Phone: 870-575-8157
Email: lxie@uaex.edu
Office hours: TBA

Prerequisite: GAQF 5405 (Statistics in Research), or equivalent

Course Description

The success of research studies starts from the good planning of research design. This course addresses the needs of the graduate students preparing for a career in agricultural and aquaculture research as professional scientists in the subjects of design, plot layout, analysis and interpretation of laboratory and field experiments. Emphasis is placed on experimental designs used in agriculture and aquaculture research. Many numerical examples and real-world problems will be presented, and the recitation through homework assignments will enhance student learning and comprehension of these techniques.

Course Objectives

- Introduce students the principles of research designs and planning.
- To learn basic ideas of random sampling
- To learn concepts of basic probability laws, confidence intervals, t-tests, F-tests
- To learn how to set up hypotheses for the research experiments
- To learn about treatment effects, replication, and randomization
- To learn the usage of blocking in experimental design
- To learn different types of experimental designs for fixed and random effects
- To learn what appropriate design to choose for a given problem.
- To learn how to analyze the data from a particular designed experiments
- At the end of class, students will be equipped with advanced statistical knowledge and techniques that are needed for their own research designs and data analysis.

Instructional Strategy

Class will be a combination of lectures and computer demonstrations for problem solving and data analysis. The students will be encouraged to actively take part in the process of problem solving during the lectures. Students will be given weekly assignments with data from real world examples that require the knowledge and skill obtained during the class. It will consolidate their understanding of statistical methods and techniques for data analysis they learn from class. Weekly computer laboratory class will be used to discuss the problem solving questions and teach computer implementation of actual data analysis (SAS programming) for the chapter topics that are covered in the lectures.

Teaching Model
The class will follow the direct interactive teaching model. In this model, there will be a clear objective for each lesson and students will be challenged to be involved in formulating solutions. The students are encouraged to discuss on the homework assignments with other classmates. Assignments and the tests will be discussed and reviewed in the class to ensure that students digest the knowledge of the topics covered in the class.

Instructional Resources
Required text:

Design of Experiments: Statistical Principles of Research Design and Analysis, 2nd Edition, By Robert O. Kuehl, Duxbury, 2000.

Computer software: SAS (Ver. 9.1)

The book, "Design of Experiments" will be used as the text book. To solve the problems and analyze the data, SAS will be used as a computing tool.

Bibliography

Design and Analysis of Experiments. By A. Dean and D. Voss, Springer, 1999.

Experimental Designs, 2nd Edition, by William G. Cochran, Gertrude M. Cox, Wiley. 1992.

Statistics for Experimenters: Design, Innovation, and Discovery , 2nd Edition, by George E. P. Box, J. Stuart Hunter, William G. Hunter, Wiley-Interscience. 2005.

SAS for Linear Models, 4th Edition, by Ramon Littell, Walter W. Stroup, Rudolf Freund, Wiley-SAS. 2002.

SAS System for Mixed Models, 1st Edition, by Ramon C. Littell, George A. Milliken, Walter W. Stroup, Russell D. Wolfinger, SAS publisher. 1996.

The Little SAS Book: A Primer, 3rd edition, by Lora D. Delwiche, Susan J. Slaughter, SAS Institute Inc. 2003.

Assignments
There will be biweekly assignments (20 points each). The assignments will be comprised of the exercise questions from the text book, and the actual data analysis with real-world examples. Problem solving questions require the detail steps of derivations and procedures to the solution for full points. Data analysis requires the summary of statistical

findings and statistical inferences from the analysis as well as test statistics. Although students are encouraged to discuss the assignments, the identical write-ups of solutions will be considered as a cheating and no score will be given. Overdue turn-in will automatically reduce 20% from full points for each additional delayed day.

Exams and Grading Policy
There will be 2 midterm exams and one comprehensive final.

Mid-term Exam1	100
Mid-term Exam2	100
Final Exam	150
HW Assignments	120
Total	470

Grading scale for this class out of full points (470) is:

A: 90-100% (470-418.3), B: 80-89% (418.2-371.3), C: 70-79% (371.3-324.3), D: 60-69% (324.2-277.3), F: 0-59% (277.2-0)

Notes: The exams will be comprised of multiple choices, short answers, and problem solving questions. The exams will be given during regular class hours in the same classroom. All the exams are closed books, however student are allowed to bring a half letter-size sheet for formulas to use during exams. Hand-held calculator is allowed to use during exams. No make-up exam will be given, except emergency situations, such as hospitalization for illness.

Cheating
No Cheating will be tolerated for the assignments and the exams. Cheating includes copying other students' homework assignment and looking at someone else's answers during exams. Cheating will result in zero score earning in the portion of an assignment or an exam.

Attendance Policy
It is mandatory for students to attend all classes. If any student must miss a class for the reasons of conference attendance, sampling trips, and others, a student must notify the instructor beforehand. The instructor is not responsible to provide class material for missing classes. It is the student's responsibility to make up the missing classes by obtaining the materials from other classmates and self-study.

Cell Phone Policy
Cell phone or any personal communication device should be turned off before entering the classroom. Any student uses such a device during class will be asked to leave class immediately and not to return.

Disability Policy
It is the UAPB policy to accommodate students with disabilities, pursuant to federal law and state law. Any Student who needs accommodations, such as special arrangements for seating and transportation, are encouraged to inform the instructor or contact with Mr. Michael Washington in Caldwell Hall, Room 205, Phone (870) 575-8293, Email: Washington-m@uapb.edu

Course Schedule

Week	Dates	Sections	Material
1		Chap. 1	Research Design Principles
2		Chap. 2	Completely Randomized
3		Chap. 3	Treatment Comparisons
4		Chap. 4	Diagnosis for data and model
5		Chap. 5	Study Variance
6		Chap. 6	Factorial Treatment Designs
7		Chap. 7	Random and Mixed Models
8		Chap. 8	Complete Block Designs
9		Chap. 9	Incomplete Block Designs I
10		Chap. 10	Incomplete Block Designs II
11		Chap. 11	Incomplete Block Designs III

12	Chap. 13	Response Surface Designs
13	Chap. 14	Split-Plot Designs
14	Chap. 15	Repeated Measures Designs
15	Chap. 16	Crossover Designs
16		Final Week

Fish Pathology

(Fish Health Protection)

GAQF 5430

Meeting Times:

Lecture	**MWF 8:00-8:50**	**Woodard 257**
Lab	**F 2:00-4:00**	**1890 Building**

NOTE: There will be lots of lab work that needs to be done at other than the official time shown above. This work may be done as needed when you are free. If you will need help, be sure to schedule it with me ahead of time. Some Friday labs may be longer than 2 hours.

Instructor: Dr. Andy Goodwin

Work Phone	575-8137
Mobile/Home	489-5997
Lab	575-8034 / 8129
Fax	575-4638
Secretary	575-8123
email	agoodwin@uaex.edu

Prerequisites: Nope

Office hours: My office and lab are in the 1890 Extension Building across the street from S. J. Parker. The fish disease lab is in the back of the building, my office is room number 133 (just wander into the building and ask for directions). When I am not in class, I am usually in one of those two places. Feel free to drop in at any time; however, you must recognize that my research and fish disease diagnostic responsibilities frequently necessitate trips to other places both on and off campus. My office hours are Monday and Wednesday and Friday from 9-11 am. **Email is a great way to contact me too**. If you can't find me, try the mobile number. Be sure to leave a message or send an e-mail.

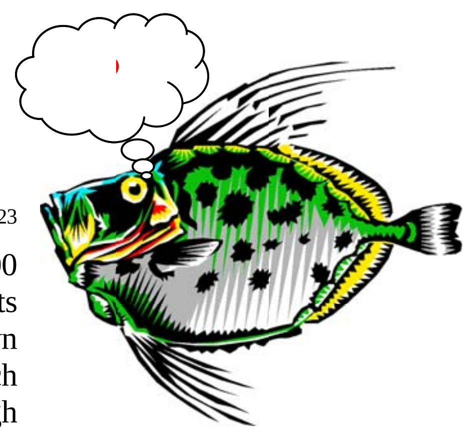
When you need help: If there is ANY way that I can help you, PLEASE DO NOT HESITATE to see me before class, after class, by phone (at work or at home!), or by email. Don't be shy, don't wait until it is too late. If you have problems or worries, SEE ME! I've given you my home phone number, **don't be afraid to call me at home in the evening (7-10 p.m. is best) or on the weekend**, and it doesn't have to be an emergency. I want you to pass this class. I want you to get a good grade. Let me help you when you have problems! The other folks

in my lab (Emily and Gwenn) will be happy to help you if they can. You can call them at my lab numbers (above) or contact them at their e-mail addresses (emarecaux@uaex.edu **or** gmerry@uaex.edu).

Academic Honesty: Sometimes you hear students say like "Cheating is okay, it doesn't hurt anybody" and "Everybody does it." Let me set the record straight. It does hurt you, it does hurt your classmates, other UAPB graduates, and the University, and NOBODY DOES IT IN MY CLASS! If you cheat, you won't learn the things that you must know to be successful and you will fail at your first job. You can cheat on tests but you can't cheat on life. That hurts you. In addition, if you graduate from UAPB and go out into the world and make a fool of yourself, it makes me look bad, it makes UAPB look bad, and it decreases the value of degrees help by other UAPB grads that really earned theirs. That hurts other people. I will watch you like a hawk as you take tests and quizzes. I will look very carefully at assignments handed in for copying and plagiarism. If I catch you cheating on a test or assignment I will give you a zero for it, we will have to pay a visit to Dr. Engle, and you probably won't pass my course. I'll be sure to notify your graduate committee too.

Test Rules:

For quizzes: All notebooks, book bags, etc. will be on the floor under your desk.
For Tests: All notebooks, backpacks, etc. will be placed in the nooks by the door.



Course Content: The emphasis in this class is to learn how investigate a fish kill and make rational decisions about what to do about it. There are at least 75 bacterial pathogens of fish, dozens of fungi, hundreds of known viruses, thousands of parasites, uncountable toxins and physiological problems, and 6.023 X 10^{23} different combinations of the above. In addition, there are 35,000 different kinds of fish, they live in a bewildering variety of habitats manmade and natural, and they move all over the world on their own and in airplanes. If we started now and spent just 5 minutes on each significant fish disease, it would take us years of class to go through them all. By the time we were done there would be 200 new diseases… And of course, that still wouldn't make you any good as a fish pathologist.

To be a good fish pathologist, you have to be a detective. Imagine that you are Sherlock Holmes and that every fish case is a mystery to be solved. Instead of fingerprints and footprints, you have lesions and livers, instead of magnifying glasses there are microscopes; the list of suspects is huge, and they never talk… The witnesses are wet and the weapons are endless… In order to be a good fish pathologist, you have to look for the clues (water quality, weather, fish species, pattern of mortality, external lesions), know how to use detective equipment (microscopes, tissue culture, histology, PCR, microbiology), be able to come up with a list of suspects (fish diseases that match the clues), and interrogate the witnesses (fish never talk, you have to question the people involved!). This is what we will emphasize this semester, being a fish disease Sherlock Holmes. We will also need to talk about the politics of fish disease. This is something I never learned about in school, but that is an integral part of fish health.

We'll start out talking about sample collection and diagnostic techniques (bacteriology, virology, molecular biology, histology and other "ologies" that we may need). Then talk about broad groups of pathogens, then move on to talking about common pathogens of particular species of aquatic animals (catfish diseases, wild fish diseases, shrimp diseases). In lab, we will start out learning techniques, and then you'll need to spend the rest of the semester using them (See "Case Studies").

Course Objectives

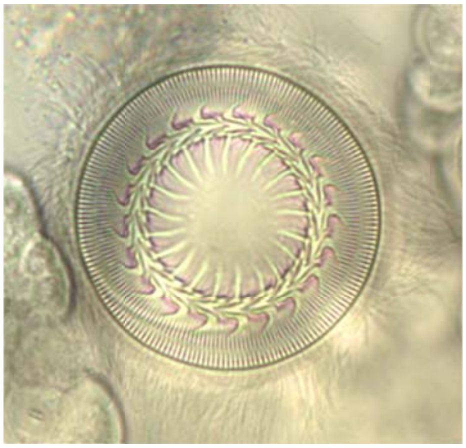
When presented with a real or hypothetical fish kill, students passing this course will know how to…

1) Ask the appropriate questions to establish all case history information needed for diagnosis
2) Choose appropriate samples and collect them in the proper way
3) Be able to analyze the samples using microbiology, tissue culture, histopathology, and PCR
4) Recognize the general clinical signs of diseases caused by broad groups of pathogens
5) Recognize important parasitic pathogens
6) Determine a correct diagnosis and appropriate method for disease management or treatment
7) Conduct diagnosis and treatment only in a manner appropriate under by law
8) Be able to prevent disease occurrences through certification and biosecurity

Instructional Resources:

There are good books on fish parasites. There are good books on fish viruses. There are good books on fish bacteria. There are books on fish histopathology. There are books on water quality. There are books on algae. There are books on fin fish. There are books on shrimp. There are books on non-infectious diseases. There are books about tumors. There are books about immunology. There are books about physiology. There are **no** books with **everything** and that is what you need. So, I will put everything that you might need on the local intranet. These resources will include…

About 1300 digital pictures of fish diseases
All of the lecture Powerpoints
Written versions of lectures
Lab exercises
The AFS-FHS Blue Book
Various fish disease texts
Fish disease keys
Scientific papers
Case studies by former students
This syllabus
Handy web links
Parasite handling guides
Biosecurity plans



And more…

If all else fails, I have all of the significant Fish Pathology (and other useful) texts in my office. Come see me and I will loan you the one that you need.

Teaching Model: The class will emphasize practical experience solving real and hypothetical fish disease cases. In support of that effort, basic information will be presented in background readings then reinforced during lecture with heavily illustrated Powerpoint presentations. Much of the class will be devoted to real world examples and actual diagnostic work in the lab. Be sure to check you e-mail daily for important new material. We will also attend a fish pathology conference.

Teaching Strategies: Students will experience the same information several times and several ways as it is presented in lecture, reviewed on the Internet, experienced in lab, and used to diagnose real fish disease cases. There will be group questions on some tests that will require you to re-think things with colleagues that may have a different perspective. Above all else, you will have to use what you learn.

Students with Disabilities: It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veteran Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

Attendance: The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

1. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.
2. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.
3. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.
4. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

If you miss a test it will be made up ***only if the absence is an "excused" one according to official UAPB policy or approved by me in advance***. Tests due to unexcused absences will not be made up and will receive an F.

Grading: **A**=90-100%; **B**=80-89.9%; **C**=70-79.9%, **D**=60-69.9%, **F**=0-59.9%

No grades will be dropped (except for those due to excused absences as outlined above).

Points	Nine Weekly Quizzes	270
	Web Links	30
	Parasite Quiz(zes)	100
	Lab Reports	100
	Diagnostic case study reports	300
	Final	200
Total		1,000

Nine Sort-of-Weekly Quizzes: Will emphasize problem solving. I describe the case, you figure out what is wrong and what to do about it. There will be some visual elements on the quiz (recognizing parasites or lesions). We will do them digitally. I'll send them out Friday by e-mail. I expect the answers back by noon on the following Tuesday. You may work with partners or small groups, but when this occurs, I expect to just get one answer e-mail with all of the participants names on it. That is, it must be obvious what the groups were. ***These are bold and Italic on the schedule.*** Grading will be based both on your approach to solving the problem, and on your conclusions. There will be some take home fish treatment problems too. On those, you must pick the right treatment and calculate the correct dose.

Web Links: One week, you will be assigned to come up with premo links for the next week's lectures. Grades will be assigned based on the number, quality, and diversity of the links.

Parasite Quiz: I show pictures of parasites, you write down the names and/or group. I will provide you with a reasonable list of those that you must recognize. The good news is that everybody will get an "A" on this. The bad news is that you will have to keep re-taking it until you get that "A". The record for most attempts needed is three, don't try to break the record! I do give some latitude on spelling…

Lab Reports: Nothing formal here. This will usually just be work sheets and pictures. It will be graded based on your demonstration that you have collected the data, thought about the implications, and presented it all in a neat and legible manner.

Diagnostic case study reports: During the semester you will be required to do three complete case studies. You will have to find sick fish, figure out what is wrong (the complete work up!!!), then present it to the class and turn it in to me in digital format. There are some examples of studies done by previous students that can be found along with the digital picture collection. Some are "A" reports, others are not. The big problem is to find sick fish with **interesting** diseases. They can come from UAPB, fish farms, the wild, the mail, or the pet store. For one of your three case reports, you may make your own sick fish. You will diagnose the disease, describe the case history, recommend treatment, and where appropriate, look at outcomes. You will need to make sure that you document everything and take lots of pictures. I will look very favorably on cool pictures to add to the class database. This work is the real substance of this class. Remember, these report are almost 1/3 of your grade! **The reports must be submitted in HTML.**

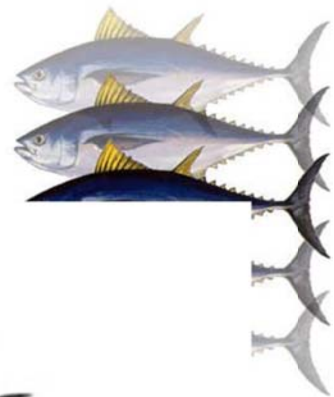
Final: Comprehensive. I tell you a story complete with pictures, you tell me what is wrong and what to do about it. It should be fun. I will allow to produce a 5 page "cheat sheet" and use it during the exam. It must be printed, it must be pretty, and it must be handed in with the test. You will be expected to demonstrate a logical approach to each problem, a correct diagnosis, and a logical, legal, and economically viable management approach.

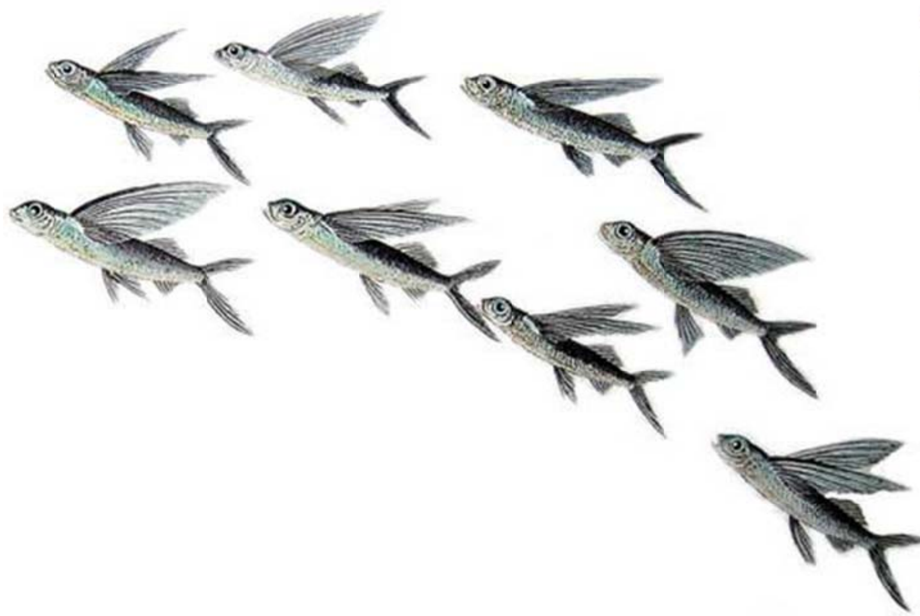
Personal Data Form: I am handing out a form for you to fill in. It will help me to get in touch with you if I need to. It will let me know where I can reach you if something goes wrong with your lab work. It will help me to find you if I know of some neat sick fish.

Instructor Absences: I am very active in National and International fish health, especially the regulatory end. The good news is that this means that you will get the latest, broadest, most cutting edge information in this class. The bad news is that it is hard for me to be in class and on airplanes at the same time. I have been working to minimize disruptions tour class schedule by traveling at night and minimizing days gone. One way or another (substitutes, pre-recorded lectures, mutually agreed upon re-scheduling of particular classes…), you will get all of the instructional time that you have paid for. I appreciate your help, and I promise to be flexible about your travel commitments. This is what I know thus far.

Jan 16 and 17, talk at Texas Aquaculture Association, No class conflicts
Feb 1-2, talk at CFAR Hot Springs. Direct conflict with class on **Friday 2/1**
Feb 9-12, 4 talks in Orlando, conflict with class on **Monday 2/11**

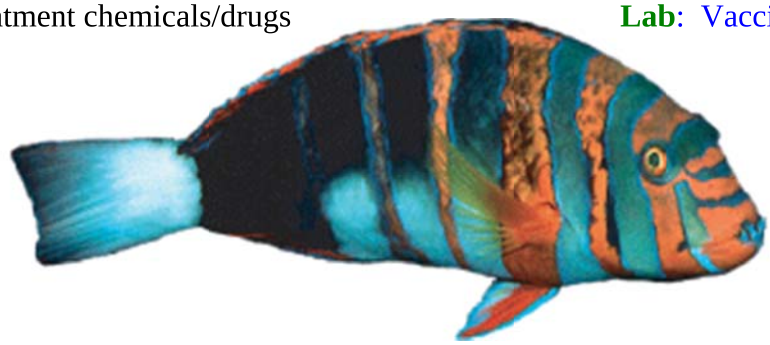
Feb 15-19, talk at KHV meeting in Israel, conflict with class on **Friday 2/15** and **Monday 2/18**
Feb 22-23, talk at OK Aquaculture meeting, no conflicts with class
Feb 29- Mar 1, talk at CFA in San Diego, no conflicts with class
March 13-15 AVMA AqVMC Chicago, conflicts with **Friday 3/14**





Fish Pathology
Schedule 2006

1/9	Syllabus, planning, scheduling, reading, plotting	
1/11	Internal Anatomy	**Lab**. Fish Anatomy **Gross** photography
1/14	Necropsy Methods, Sampling, and Clues	
1/16	Intro to Bacteria	
1/18	Identification Of Bacteria	**Midilab**. Identifying Bacteria Tubes-o-plenty
1/21	**Holiday: Martin Luther King's Birthday**	
1/23	Intro to Parasites 1	
1/25	Intro to Parasites 2	**Midilab**: Identification of Parasite Photomicroscopy
1/28	Intro To Viruses and cell culture	
1/30	Classical virology samples, cultures, strategies, ID	
2/1	***Parasite Quiz 1***	**Megalab**: Tissue Culture & Viruses
2/4	PCR and molecular methods	
2/6	Applying molecular methods to Parasites, bacteria, and fungi diagnosis and ID	
2/8	Hematology and Fungi (an odd couple)	**Megalab**: PCR
2/11	Osmoregulation	
2/13	Immunity	
2/15	Vaccines	**Megalab**: Histology
2/18	"Stress" The Real Story	
2/20	Osmo, Immuno, Hormono all tog	
2/22	Histology Methods	**Lab**: Vaccines 1
2/25	Water Quality & Fish Health	
2/27	Treatment legalities	
2/29	Treatment chemicals/drugs	**Lab**: Vaccines & WQ



3/3 Calculating and applying Drug Doses
3/5 Intro To Toxicology / Neoplasia
3/7 Man-Made and Natural Toxins (Acid Rain, Metals, Estrogenics, Algae, *Physteria* Hysteria) **Lab**: Osmoreg
3/10 Important Diseases Of Catfish 1
3/12 Important Diseases Of Catfish 2
3/14 Important Diseases Of Catfish 3 Lab: Case Work

3/17 Important Diseases Of Cyprinids 1
3/19 Important Diseases Of Cyprinids 2
3/21 Important Diseases Of Cyprinids 3 Lab: Case Work

3/24 Vacation (Uninhibited Research Period)
3/26 Vacation (No Classes To Interrupt Your Studies)
3/8 Vacation (Perfect Opportunity For That Big Experiment) Lab: Vacation

3/31 SVCV and how fish diseases are regulated
4/2 Fish health inspection
4/4 Biosecurity and disinfection **Lab**: Vaccine Titers

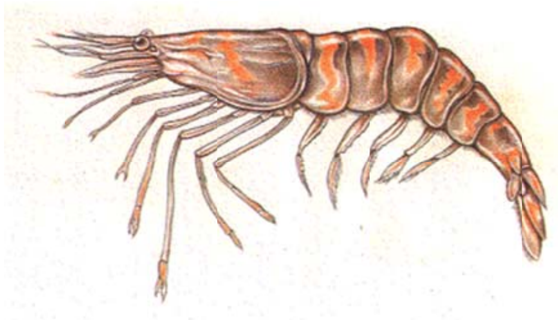
4/7 The VHS story
4/9 Important Diseases Of Salmonids 1
4/11 Important Diseases Of Salmonids 2 Lab: Case Work

4/14 Diseases Of Wild Marine Fish
4/16 Diseases Of Wild Freshwater Fish
4/18 Diseases Of Shellfish Lab: Case Work

4/21 "Situational" diseases (hatchery, pets, recirc) part 1
4/23 "Situational" diseases (hatchery, pets, recirc) part 2
4/25 Fish disease ethics Lab: Case work

4/28 Case Reports reported
4/30 Case Reports reported
5/1 ***Case Reports due in HTML*** Lab: Case reports if needed

FINAL 5/6-9 Somewhere in there…




Aquaculture/Fisheries Center
Animal Welfare Policy 2005

The faculty, staff, and students of the UAPB Aquaculture/Fisheries Center conduct scientific research using living animals and recognize that the welfare of those animals is of paramount importance both for ethical reasons and to insure the quality of research results. In order to insure that animal welfare concerns are adequately addressed, all research done at the Center adheres to the following principles.

1) Fish are animals and must be treated with care and respect.

2) While there is significant scientific evidence showing that fish do not experience pain in the same way as do higher animals, there is sufficient controversy that we will always err on the side of caution. Fish will be handled as gently as possible and anesthetizing prior to procedures that would be reasonably expected to cause significant pain in a higher animal.

3) Studies will be designed to minimize trauma to experimental animals to the greatest practical extent.

4) Fish in studies will be protected from disease by biosecurity guidelines administered by the Center Organism Importation Needs Committee. In the event that fish show signs of diseases, the Center Fish Disease Laboratory will be consulted and the fish provided with disease treatments most appropriate to the study and to their potential food animal status. All dead animals will be promptly removed from ponds, tanks or other fish holding containers.

5) Environmental conditions will be maintained to provide oxygen levels and water quality consistent with good fish health. In the event that water quality deteriorates below acceptable levels, every practical effort will be made to re-establish acceptable conditions. The nature of these efforts will be chosen based on the study design.

6) When fish are sampled, harvested, or handled, they will be kept submerged as much as possible and tranquilizers, salt, and prophylactic disease treatments used as appropriate to mitigate the effects of stress. Fish will be gradually acclimated to temperature changes.

7) Wild vertebrate animals (snakes, turtles, amphibians, mammals, birds) invading experimental ponds or other experimental facilities will be harassed into leaving the experimental site, returned to the wild, or (if allowed by state and federal law) killed by the most humane practical method.

8) When studies are completed, remaining live animals will be sold for aquaculture or food use, donated to state or federal agencies, or euthanized with a suitably labeled fish anesthetic and disposed of according to station policy.

9) When wild fish are sampled they will be handled gently, maintained in suitable containers with sufficient oxygen and water quality. If they are to be preserved, they will be euthanized with a suitable labeled fish anesthetic prior to preservation. If they are to be measured, tagged, or subjected to other procedures prior to live release, the fish will be tranquilized if such treatment decreases trauma experienced by the animals and their release to the wild does not conflict with drug use regulations. When wild fish are released, it will be into an appropriate habitat as close to their site of capture as practical.

10) Electrofishing procedures will be periodically reviewed and equipment updated if necessary to ensure the least harm to fish during sampling procedures. For more details see *Snyder, D. E. 2003. Electrofishing and its harmful effects on fish. Information and Technology Report USGS/BRD/ITR-2003-0002, U. S. Government Printing Office, Denver, CO.*

11) All research will be conducted with all of the permits, licenses, and animal welfare oversight required by state and federal law.

12) For more detailed guidance than that provided by this policy, the American Fisheries Society "Guidelines for the Use of Fishes in Research" (currently at http://www.fisheries.org/html/Public_Affairs/Sound_Science/Guidelines2004.shtm) will be followed. Those desiring additional information on fish welfare may consult this comprehensive review.

Erickson, H. S. 2003. Information resources on fish welfare 1970-2003. Animal Welfare Information Center Resource Series N. 20, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, MD.

Fish Physiology (GAQF 5420)

Semester: Fall
Credit Hours: 4
Pre-requisites: None
Meeting Days/Time: TBA
Instructor: Haukenes

Course Description: This course will impart an understanding of the organization of diverse physiological systems that enable fish to flourish in diverse aqueous and marine environments. The course begins with an examination of energy mobilization and a thorough overview of the systems responsible for the maintenance of homeostasis. In the second part of the course sensory biology and the neuroendocrine system is presented to illustrate how environmental signals are integrated and responded to. Finally, examinations of examples of applications of fish physiology to fisheries management and aquaculture will be presented.

Principal Text: The physiology of fishes (3rd edition). 2006. D.H. Evans and J.B. Claibourne, editors. CRC Press, Taylor and Francis Group, Boca Raton, FL

Assigned supplementary readings from the primary peer reviewed literature will be made available in the library.

Credit Hours: 4 credits. The course will be comprised of two 75 minute lectures (150 minutes/week) and one two-hour weekly laboratory. The laboratory component will consist of exercises that offer instruction on techniques to evaluate physiological processes of live fish, student led discussions of current research in physiology, and discussions surrounding term projects.

Evaluation procedures: Three examinations will be administered to the class: two unit examinations delivered during the semester and final examination administered at the end of the semester. Each student will also be required to complete a term project either in the form of a term paper or a draft research proposal. Prior to initiating the project a one page abstract of the project will be turned into the instructor. Completed term projects will be distributed to classmates and each student will be responsible for preparing a two-page review of a term project other than there own. Reports describing the outcome of laboratory exercises will turned in to the instructor and graded. Each member of the class will prepare a presentation to present synopsis of a recent original research paper to the class of and lead a discussion the area of current research described in the original research paper.

Examinations

Unit exam 1	100
Unit exam 2	100
Final exam:	200

Term Project:

Project abstract:	10
Term Paper /Research Proposal:	100
2 page critique of someone else's paper:	10

Laboratory Exercises & Presentation:

Presentation:	40
Laboratory Reports:	40

Course Objectives:

a. To define processes involved with the catabolism and utilization of energy.
b. To define relationships between oxygen consumption and energy utilization
c. Illustrate the similarities and differences in specific physiological systems among varying species.
d. Define the levels of integration among major physiological systems and explain the coordination of molecular and cellular events through to whole animal level of organization through evaluations on selected fish species
e. To describe how organisms interact with their environments and how environmental conditions modulate physiological regulatory mechanisms
f. Explain the major neuroendocrine axes that modulate growth, reproduction, and stress.

Course Outline:

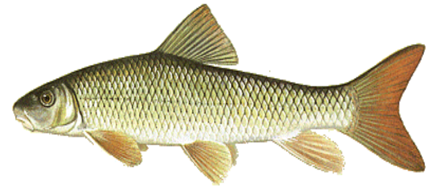
Energy substrates and utilization
- ATP
- Energy substrates
- Metabolic rate
- Swimming performance models

Life in an Aquatic Medium
- Gas Exchange
- Acid Base Regulation
- Osmoregulatory Issues
- Nitrogen Excretion and Metabolism

Integration of Information
- A primer on signal transduction
- Electroreception, Vision, Chemoreception
- Autonomic and central nervous systems
- Neuroendocrine systems

‘Applied’ Fish Physiology
- Induction of spawning of fish
- Stress in fish
- Bioenergetics
- Endocrine disruption
- Behavioral physiology

Fish Population Dynamics (3 credit hours)
Aquaculture/Fisheries (GAQF) 5325



University of Arkansas at Pine Bluff
Fall semester, 2008

Instructor: Dr. Michael A. Eggleton
Office: Woodard Hall, Rm 220 (enter through 211)
Office phone: 870-575-8100
Fax: 870-575-4637
E-mail: meggleton@uaex.edu

Class Times: Lecture: Tuesday/Thursday, 8:00am-9:15am, Woodard Hall, Rm 257
Other times and locations announced as needed.
Turn cell phones and pagers off during ***all*** class activities.

Office hours: 9:00am - 11:30am, Monday and Wednesday.
Other hours by appointment, though I am usually around every day. Feel free to email or call anytime. If I am unavailable, I will return your call as soon as possible.

Prerequisite: College algebra and general ecology; introductory statistics is recommended

Required Text: None – I will be provide excerpts from other texts throughout the semester.

You must provide a working email address that you check regularly. Announcements and other basic information about this course will sometimes be distributed this way.

1) COURSE OVERVIEW

Course Objectives:

The main objectives for this course are to: 1) expose students to basic concepts in fish population dynamics, 2) provide students hands-on experience using standard population dynamics models and statistical software commonly used by fisheries biologists, and 3) train students in interpreting model and statistical results with regard to analysis of fish population data.

Course Content:

This course is designed for students to establish an integrated professional foundation in population dynamics and will provide the necessary tools for assessing recreational and commercial fisheries for management purposes. Methods for estimating population parameters (e.g., size, density, growth, recruitment, and mortality) will be presented. This course is highly quantitative and students will be required learn and use a variety of modeling and statistical techniques to interpret basic fisheries data. Students also will use FAST (Fishery Analyses and Simulation Tools) to predict yield and catch composition for recreational and commercial fisheries.

2) COURSE GRADING

Composition of Total Grade:	%Total grade
Mid-Term Exams (100 points each)	27
Comprehensive Final Exam (150 points)	20
Homework problems (8) (50 points each)	53
	100% (750 points)

Grade Assignment:
Final grades will be based on the total points accumulated from all exams and exercises. Grades will be assigned according to the following schedule:

A = 90.0-100%
B = 80.0-89.9%
C = 70.0-79.9%
D = 60.0-69.9%
F = 0-59.9%

Exams:
As listed above, there will be two (2) 100-point mid-term exams during the semester, and a comprehensive final exam worth 150 points. These exams will be comprised of short answer, essay, and problem-solving questions. Exams will cover all information presented in class lectures, required readings, laboratory exercises, and homework problems. Calculators will be needed for all exams.

Make-up exams will not generally be given. If an exam is missed without a valid excuse, you will receive a zero on that exam. Make-up exams will be considered under extreme circumstances (e.g., death in the immediate family, student illness), provided appropriate documentation can be provided to support such. The final decision lies with the instructor. Every effort should be made to take exams at their properly scheduled times. If an exam must be missed, the student should notify the instructor or departmental secretary (Delila) *prior* to the scheduled exam. If the instructor decides a make-up exam is warranted, it will be scheduled at the convenience of the instructor (this may mean evenings or even weekends).

Homework assignments:
There will be several homework assignments given during the semester. These assignments will pertain to the fisheries concepts and models presented and discussed during lectures. This course does not have a formal lab, but we will do some lab-like assignments. Assignments will encompass doing hand calculations, performing

statistical analyses, and/or running computer models on fisheries data that are provided. Occasionally, you may need to obtain references outside of regular class. Homework assignments will due approximately one (1) week after they are assigned. Given that this is a graduate-level course, I will be flexible as much as possible with regard to field schedules of individual students, conference attendance, and other professional or scholarly endeavors.

Extra credit opportunities:
From time to time during the semester, I will offer extra credit opportunities. I will submit a question by email to the whole class. The first student who returns the correct answer can earn extra credit points. It may be something in the textbook or maybe something else fisheries-related.

***** Any form of cheating will be handled in the appropriate manner according to university policy. A zero on the assignment is the minimum repercussion. Cheating will result in a zero on the assignment at a minimum and possibly worse. Reminder - information copied directly from the Internet and presented as original work is cheating.**

<u>**Test rules**</u>**: Book bags in the floor; no jackets, hats, sunglasses, laptop computers, or cell phones allowed out.**

<u>**Homework rules**</u>**: You can work together but finish them alone. It is very obvious when a student copies another's work and then rephrases or rewords small parts of it. Ditto for copying materials off of the Internet. I can easily use Google to locate Internet materials that have been copied verbatim.**

UAPB and SAFHS Class Attendance Policy
The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

6. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.
7. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

8. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other

absences are unexcused.

9. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

10. Each instructor is free to establish their own penalties for lack of class attendance.

Fish Population Dynamics policies
Consistent attendance is mandatory. However, as this a graduate-level course and students are invariably involved in research, conference attendance, etc., I will be as flexible as possible. Attendance will be taken for each class and lab session. This is required by the University and reported periodically for financial aid qualification. Each student is responsible for all material presented in missed lectures and labs, and assignments made therein. If you miss a scheduled class period, you need to locate a fellow student to obtain missed material.

Pursuant with UAPB policy for a 3-credit course, if a student has four (4) unexcused absences, the instructor will call a meeting with the student to make him/her aware of the situation. With additional unexcused absences, the student will incur a letter-grade penalty at the end of the course. In the case of excessive absences, the instructor will likely recommend that the student withdraw from the class and enroll again the next time it is offered.

****Remember—all absences are <u>unexcused</u> until the student provides appropriate documentation. The instructor is not responsible for locating the student after missing class and informing him/her of missed material or assignments or seeking an excuse for the absence***. *This is your responsibility.*

Students with disabilities:
It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veteran Affairs and Disability Services located in Caldwell Hall, Suite 205, Phone (870) 575-8293.

3) INSTRUCTIONAL APPROACH

Teaching Model and Strategies:
Fish Population Dynamics is taught at the graduate level only, and is a very hands-on course with a fairly traditional formula. Basic information will be presented during lectures. Live demonstrations and hands-on experience will occur during class. Exercises will integrate material presented in lectures with standard models, statistical approaches, etc. used in the fisheries discipline, with much emphasis placed on data interpretation. Exams and homework assignments will serve to validate learning.

Instructional resources:
We will use some Internet resources, but will mostly use basic “canned" computer programs and models and statistical software that are used by fisheries professionals for such purposes.

Bibliography:

Guy, C.S. and M.L. Brown. 2007. Analysis and interpretation of freshwater fisheries data. American Fisheries Society, Bethesda, Maryland.

Gotelli, N.J. 2001. A primer on ecology, 3rd edition. Sinauer Associates Publishing, Sunderland, MA.

Haddon, M. 2001. Modeling and quantitative methods in fisheries. Chapman and Hall/CRC Press, Washington, D.C.

Kohler, C. C., and W. A. Hubert, editors. 1999. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Murphy, B. R., and D. W. Willis, editors. 1996. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Quinn, T.J. and R.B. Deriso. 1999. Quantitative fish dynamics. Oxford University Press, Oxford, England.

Ricker, W.E. 1975. Computation and interpretation of biological statistics in fish populations. Fisheries Research Board of Canada, Bulletin 191.

Walters, C.J. and S.J.D. Martell. 2004. Fisheries ecology and management. Princeton University Press, Princeton, New Jersey.

General Course Outline: (subject to change)

My goal is cover all of the material listed below. However, I reserve the right to alter the scheduling or chronology of materials if I deem it necessary for the good of the whole class. This would only be done to accommodate student attendance at a conference or a outside guest lecturer.

1. Introductory Material
   - course goals
   - what is a fishery?
   - principles of population dynamics
   - what is a model?
   - stock assessment and fisheries management

2. SAS (Statistical Analysis Systems) and Excel
   - linear regression primer
   - basic functions of Excel
   - program files, data files, output files, log files, etc. of SAS
   - basic programming code for data reduction and statistical analysis
   - basic interpretation of outputs

3. Population Size
   - estimation techniques and confidence intervals
   - area density method
   - change in ratio method
   - depletion methods
   - mark-recapture models

4. Population Growth and Condition
   - rates of increase (finite versus instantaneous)
   - derivation
   - fish production
   - growth models
   - estimation techniques and confidence intervals
   - calculation of indices of fish condition

5. Age-Growth Relationships
   - fish age-and-growth estimation techniques
   - backcalculation of length at age
   - reporting fish growth
   - models of fish length, weight, and age
   - comparison of growth rates using linear and nonlinear methods

6. Mortality
   - finite and instantaneous rates
   - fishing and natural mortality computation
   - compensatory versus additive mortality
   - estimation techniques and confidence intervals

7. Recruitment
- definitions
- estimation techniques and confidence intervals
- stock-recruitment relationships
- influence of environmental factors
- stochastic methods

8. Fish Population Modeling
   A. graphical
      - fishery surplus production
      - yield-per-recruit models

   B. deterministic
      - Ricker tabular model
      - Beverton and Holt equilibrium yield model
      - Graham-Schafer surplus production curve

   C. stochastic
      - use and misuse of stochastic models
      - population cycles in fishes
      - GIFSIM
      - MOCPOP
      - Excel Poptools

   D. FAST (Fishery Analysis and Simulation Tools)

9. Fish Bioenergetics (optional)
- definition of terms
- uses of bioenergetic models
- estimation techniques and confidence intervals
- influence of environmental factors
- Wisconsin fish bioenergetics model

Course Prefix and Numbers: GAQF 5371
Course Title: Graduate Fisheries Management
Semester: Spring 2009
Course Schedule: T,Th 9:30am-10:45am Woodard Hall Room 116

Instructor:	Dr. S. Lochmann	**Office:**	230 Woodard Hall
Office Phone:	575-8165	**Office E-mail:**	slochmann@uaex.edu
Office Fax:	575-4637	**Office Hours:**	M, W, F 8:30am-10:30am or by appointment

Text: Inland Fisheries Management in North America. 1999 Second Edition. Kohler and Hubert (eds.) (You are required to purchase this text book and bring it to class). There are also reading assignments from primary literature. Copies of these primary literature papers are available in the AFREL.

Prerequisites: none

Credit Hours: 3 hours credit, including two seventy-five minute lectures per week.

Course Description: This course integrates the fisheries data with problem-solving techniques to achieve objective-oriented outcomes in fisheries management. Dimensions of fisheries including legal aspects, population assessments, and specific management practices will be investigated.

Course Content: Students will learn through exams, discussions, exercises, and role-playing games an understanding of fundamental concepts of fisheries management including: 1) history of management, 2) the management process, 3) public communication, 4) basic population dynamics, 5) fisheries statistics, and 6) fisheries regulations.

Bibliography: The course will use the Kohler and Huburt text and the reading list attached below. Some aspects of the course will rely on Ricker (1975), but handouts for this material will be provided when appropriate.

Instructional Resources: A series of excel files will be made available during the semester on the Aquaculture/Fisheries network neighborhood. These files are the basis of some lectures and homework assignments.

Course Objectives:
1. After viewing the REFLECTIONS Presentation students will explain the evolution of fisheries management in the United States by producing a timeline with at least 25 milestones.
2. On an examination students will be able to diagram, identify and explain the management process without errors and in a role-playing environment; students

will apply the management process to a natural resource problem and come to a resolution of the problem.

3. During an examination, students will be able to identify and explain the communication process as listed in Chapter 3 of the text without errors.
4. If given a list of Environmental and Natural Resources Legislation, students will be able to explain the significance of each piece of legislation to the field of natural resource management without errors.
5. In a role-playing environment, students will be able to resolve multi-user resource conflict so that all users are satisfied.
6. When asked, students will be able to diagram and identify the dynamics of a fish population.
7. Given a data set, a formula sheet, and a calculator, students will be able to use three different methods of population abundance assessment (area sub sampling, mark/recapture, and depletion) to estimate population abundance with 95% confidence intervals without errors.
8. Using a data set, formula sheet, and Excel, a student will be able to calculate instantaneous mortality, annual mortality, and fishing and natural mortality without errors.
9. Using length data, a formula sheet, and a calculator, a student should be able to calculate a fish's age using the Von Bertalanffy growth equation without errors.
10. Using FAST and a data set, a student should be able to evaluate the utility of a minimum length limit on a fish population and correctly determine whether the length limit is useful.
11. Using length frequency data, a formula sheet, and a calculator, a student should be able to calculate PSD, Fulton's K, Le Cren's K, and relative weight with no errors.
12. Given a data set and a rubric, a student should be able to calculate an IBI for two different streams and correctly determine which is most impacted.
13. On an exam, a student should be able to explain any regulation in the AGFC Fisheries Regulations handbook and correctly identify the management objective which the regulation attempts to address.
14. When asked, a student should be able to list 10 species used for stock enhancement and the conditions under which each species might be used for enhancement.
15. On an exam, a student should be able to explain all of Swingle's stocking options, listing species, size to stock, and number to stock, time to stock, and harvest regulations for each stocking option.
16. Given a set of management objectives, a student should be able to outline an impoundment management plan including stocking strategy, fertilization scheme, vegetation control, and fish control structures.

Evaluation: Exams will be made of combinations of short answer, essay, problem solving, matching, multiple choice, and diagram labelling. Exams are CLOSED BOOK AND NOTES unless otherwise stated by the instructor. Exams missed due to unexcused absences cannot be made up.

Grading:	Mid-Term	200 pts
	Final Exam	200 pts
	Homework Assignments	100 pts
	Writing Assignments	100 pts
	Class Participation	100 pts
	Management Plan	100 pts
	A = 720 to 800 pts	90%-100%
	B = 640 to 719 pts	80%-89%
	C = 560 to 639 pts	70%-79%
	D = 480 to 559 pts	60%-69%
	F = less than 479 pts	- 59%

Homework Assignments: The homework assignments will be exercises built around basic population assessments, dynamics, and statistics (area subsamples, depletion, mortality, recruitment, growth, condition, relative stock density, diversity indices, richness indices, and biotic integrity) utilizing excel spreadsheets. Each homework assignment will be worth 10 pts.

Writing Assignments: Writing assignments will entail searching for information using the web and various other databases, synthesizing and summarizing that information, and presenting the information in written and/or oral formats. Each writing assignment will be worth 10 pts.

Instructional Strategies: The strategies utilized in this course will include:

a) Interactive Lectures, which involve students in the learning process while providing complete control to the instructor. These activities enable a quick and easy conversion of a passive presentation into an interactive experience. Different types of interactive lectures incorporate built-in quizzes, interspersed tasks, teamwork interludes, and participant control of the presentation.

b) Classification Card Games, which involve pieces of information (such as facts, concepts, technical terms, definitions, principles, examples, quotations, and questions) printed on cards. These games borrow procedures from traditional playing card games and require players to classify and sequence pieces of information from the instructional content.

c) Webquests, which are based on a format developed by Bernie Dodge and Tom March at San Diego State University. They feature a special type of inquiry learning in which participants collect information from the Web. WebQuests focus on using information rather than merely retrieving it. A typical WebQuest requires participants to analyze, synthesize, and evaluate the information from the Web; and

d) Closers, which are activities conducted near the end of a session. They are used for reviewing main points, tying up loose ends, planning application activities, providing feedback, celebrating successful conclusion, and exchanging information for future contacts.

Teaching Models: We will be using the Cognitive approach to teaching and will work mostly at the Knowledge level during the semester. We will use the “information processing approach” to developing a knowledge base. This means we will use tools and techniques to move information from sensory memory through short-term memory to long-term memory. The techniques we will attempt to develop will include imaging, and first letter sentences.

Students with Disabilities: It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University’s commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veteran Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

Class Attendance Policy: ATTENDANCE OF LECTURES IS REQUIRED. BE ON TIME. PUNCTUALITY IS A MEASURE OF RESPECT FOR YOUR CLASSMATES AND INSTRUCTOR. The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

1. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

2. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

3. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.

4. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

5. Students who are consistently absent from class without an excuse will have their final class grade lowered two letter grades.

A Management Plan will be required in this course. The subject of the management plan will be a lake sampled during the course of the semester. We will measure nutrients, water chemistry, and fish community composition. Alternative management options will be suggested. The most appropriate management option will be selected by the student and presented as a lake management plan (of the type that would be sent to a lake advisory committee). The plan must include summaries of the existing conditions, recommendations, and an estimate of costs involved in accepting the management recommendation. The management plan is due April 15.

Class participation is graded. I expect students to be able to discuss material from daily reading assignments. I expect students to present their opinions orally in a coherent fashion and to participate in role playing exercises.

NOTE: The grade on all assignments and the term paper will be reduced by 10% for each business day it is late. You should keep a copy (electronic or hard) of all the assignments till the end of the semester in case the instructor miss-places your work.

Textbook Policy: All students must purchase the text book and bring it to class each day. Students without a text book in class will lose class participation points for the day. Students are also to bring their assigned reading material to class each day and be ready to discuss, in depth, the content of the reading.

Cell phones and pagers: Turn off your cell phones before class. Noisy disruptions are unacceptable as is leaving the classroom to take a call.

Week	Month	Date		Read Ch.	Also Read
1	Jan	13	Introduction and assignments	1	Hardin (1968)
		15	Historical fisheries management	1	Moffet (2001) Reflections (DVD)
2		20	Management process	2	Barber and Taylor (1990), Bain (1987)
		22	Management process and user conflicts	2	Hanna and Smith (1993)
3		27	Management process and tribal rights	2	Marsh and Johnson (1985), Usher (1987)
		29	Communications	3	Fuller (1991)
4	Feb	3	Federal laws	4	Mays et al. (1990)
		5	Green River & McMullin (RPG)		
5		10	Federal laws	4	
		12	Ecosystem management	5	Grumbine (1993)
6		17	Population dynamics - area sub m/r	6	
		19	Population dynamics depletion	6	Maceina et al. (1995)
7		24	Population dynamics - mortality	6	Maceina et al. (1998)
		26	Hatchery fish count (RPG)		
8	March	3	Population dynamics - growth	6	Beamesderfer and North (1995)
		5	Biological data - l/w condition	7	
9		10	**Mid-Term**		
		12	Biological data - PSD and RSD	7	Willis et al. (1993)
10		17	Biological data - diversity	7	
		19	Biological data - IBIs	7	Schulz et al. (1999)

		24	***SPRING BREAK***		
		26	***SPRING BREAK***		
11		31	Small impoundments	21	Jackson and Stone (1999), Cichra (xxxx)
	April	2	Harvest restrictions	17	Allen and Miranda (1995), Beamesderfer (2000)
12		7	Lake & reservoir management	22	Miranda (1996)
		9	Water level management	22	Willis (1986)
13		14	Felsenthal user conflict (RPG)		
		16	Stream habitat management	10	Roper et al. (1997), Kauffman et al. (1997)
14		21	Stream habitat restoration	10	Travnichek et al. (1995)
		23	Stocking efforts	14	Boxrucker (1986) , Buynak and Mitchell (1999)
15		28	Dam removal	20	Blumm et al. (1998)
		30	Species management plans		AGFC Largemouth Bass Management Plan
	May	5	***FINALS WEEK***		
		7	***FINALS WEEK***		

Reading List

Chapter 1. History of Inland Fisheries Management in North America

Hardin (1968) Tragedy of the Commons

Moffet (2001) Reflections

Chapter 2. The Process of Fisheries Management

Barber and Taylor (1990) The Importance of Goals, Objectives, and Values in the Fisheries Management Process and Organization: A Review.

Bain (1987) Structured Decision making in Fisheries Management: Trout Fishing Regulations on the Au Sable River, Michigan

Hanna and Smith (1993) Resolving Allocation Conflicts in Fishery Management

Marsh and Johnson (1985) The Role of Stevens Treaty Tribes in the Management of Anadromous Fish Runs in the Columbia Basin

Usher (1987) Ontario Lake of the Woods Fishery: Economic and Social Analysis

Chapter 3. Communications for Effective Fisheries Management

Fuller (1991) Chapter 4. Crucial Communication Skills for Negotiators in “The Negotiator’s Handbook”

Chapter 4. Legal Considerations in Inland Fisheries Management

Mays et al. (1990) History of the Instream Flow Issue in Arkansas

Chapter 5. Ecosystem Management

Grumbine (1993) What is Ecosystem Management

Chapter 6. Dynamics of Exploited Fish Populations

Maceina et al. (1995) Estimating Harvestable Largemouth Bass Abundance in a Reservoir with an Electrofishing Catch Depletion Technique

Maceina et al. (1998) Use of Equilibrium Yield Models to Evaluate Length Limits for Crappies in Weiss Lake, Alabama

Beamesderfer and North (1995) Growth, natural mortality, predicted response to fishing for largemouth bass and smallmouth bass populations in North America

Chapter 7. Practical Use of Biological Statistics

Willis et al. (1993) Stock Density Indices: Development, Use, and Limitations

Schulz et al. (1999) An Index of Biotic Integrity: A Test of Limnological and Fish Data from Sixty Florida Lakes.

Chapter 21. Small Impoundments

Jackson and Stone (1999) Managing for big largemouth bass in Arkanas ponds

Cichra (xxxx) Managing Florida Ponds for Fishing

Chapter 17. Managing Fisheries with Regulations

Allen and Miranda (1995) An evaluation of the value of harvest restrictions in managing crappie fisheries.

Beamesderfer (2000) Deciding when intervention is effective and appropriate.

Chapter 22. Natural Lakes and Large Impoundments

Miranda (1996) Development of reservoir fisheries management paradigms in the twentieth century.

Willis (1986) Review of water level management in Kansas reservoirs

Chapter 10. Stream Habitat Management

Roper et al. 1997. Stream Restoration: Is Fisheries Biology Enough?

Kauffman et al. 1997. An Ecological Perspective of Riparian and Stream Restoration in the Western United States

Travnichek et al. (1995) Recovery of a warmwater fish assemblage after the initiation of a minimum-flow release downstream from a hydroelectric dam.

Chapter 14. Stocking for Sport Fisheries Enhancement

Boxrucker (1986) Evaluation of supplemental stocking of largemouth bass as a menagement tool in small impoundments.

Buynak and Mitchell (1999) contribution of stocked advanced-fingerling largemouth bass to the population and fishery at Taylorsville Lake, Kentucky

Chapter 20. Large Rivers

Blumm et al. (1998) Saving Snake River Water and Salmon Simultaneously…

AGFC Largemouth Bass Management Plan

MANAGEMENT OF SMALL IMPOUNDMENTS
GAQF 5435

Instructor:	Faculty	**Office Hours:**	MW 9-10:30; T 9-11
Telephone:	(870) 575-8136 office	**Class time:**	MWF 11 a.m.
		Lab:	T 2-5 p.m.
E-mail:			

COURSE DESCRIPTION: This course provides students with the principles that govern the management of small impoundments for recreational fishing. Students will learn about population balance, field techniques to assess fish stocks, methods to correct unbalanced populations, aquatic plant identification, and water quality parameters important to small impoundments.

TEXTBOOK: There is currently no textbook that thoroughly covers the theory and practice of managing small impoundments. We will use a variety of references that will be handed out in class or made available electronically at least one week in advance of covering the material.

CLASS STRUCTURE: Students must read all assignments prior to arriving in class. Class time will be spent in discussion of the reading material, presentation of formal lectures, problem-solving exercises related to the issues covered in the readings, and on application of the information to analyses that you will develop in the laboratories.

COURSE OBJECTIVES

1. To provide a historical perspective of small impoundment management and the importance of small impoundments in the development of traditional fisheries science.

2. To understand the procedures for proper pond design, construction, stocking, and assessment.

3. To understand the physical, chemical, biological, and structural environments of small impoundments and their implications on management objectives and techniques.

4. To provide students with the principles governing management of small impoundments for recreation fishing and other management objectives.

5. To develop management plans for local small impoundments using concepts described in class.

COURSE OUTLINE

I. Historical Perspectives

This unit will discuss the historical importance of small impoundments, examine how management theory has developed over the past century, and discuss how new tools have been developed to aid in small-scale fisheries management.

II. The Pond Environment

This unit will explore the limnological characteristics of small impoundments, water quality, and productivity. We will discuss management of productivity using lime and fertilizer, issues with water quality and oxygen depletion, and problems leading to fish kills.

III. The Ecological Community

This unit will discuss the trophic structure in small impoundments and the potential for top-down and bottom-up control of the pond community. We will discuss various species complex options and the pros and cons of each. We will examine the bioenergetics of these food webs and formulate models for trophic dynamics.

V. Build It Right!

This unit will examine ways to construct small impoundments that maximize productivity/fishability while minimizing pond problems such as aquatic weeds and poor water quality.

VI. Stock it Right! Fish it Right!

This unit will examine management options, assessment protocols, and long-term management plans. We will discuss species selection, stocking densities and periodicities, determination of pond balance, and troubleshooting of pond problems.

CLASS PROJECTS

There will be several class projects in association with laboratory exercises during the course of the semester. In addition, each student will be responsible for individual projects that will be completed and presented at the end of the semester. Specific project formats and topics will depend upon individual student research interests, but the general topic selection must be compatible with the study of small impoundments. Some laboratory exercises may be directed towards individual projects, but students are expected to conduct much of their research on their own. More extensive weekend sampling trips may be arranged if needed. More information on individual projects will be given early in the semester.

TEACHING MODEL

Information will be presented in multiple formats for this course, including digital and hardcopy reading materials, videos, Internet sites, Powerpoint lectures, and various other medias. Class time will be spent discussing the material, working on solving problems related to the reading materials, and presentations of real-world examples.

INSTRUCTIONAL STRATEGIES

This course will utilize both critical thinking and hands-on approaches. Lectures will involve group discussions to stimulate students in learning complex concepts, and laboratory exercises will provide on-site learning opportunities.

GRADING

Students are expected to adhere rigidly to the due dates for each assignment. Late assignments will lose 10% of the total possible score for each day they are late. Grades will be determined as defined below.

Midterm Exam	250 points
Final Exam	250
Laboratory Assignments	150
Individual Project and Presentation	350
Grade	1000

A = 900-1000
B = 800-890
C = 700-790
D = 600-690
F < 600

ATTENDANCE

You are now professionals and are expected to attend every class. This is a small class and I will know when you are not present. Do not put me in a position to have to take disciplinary action. **This applies for lecture, lab, and exams!**

EXTRA HELP

I am always available for extra help by appointment or at any time that I am in my office. However, it is best to e-mail me and make an appointment if you need to see me outside of my office hours.

CHEATING

Cheating will not be tolerated and will be punished with a “0” on the assignment, project, or exam in question.

STUDENTS WITH DISABILITIES:

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the Department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Michael Washington, Office of Disability Services located in Caldwell Hall, Room 202, telephone (870) 575-8293.

INSTRUCTIONAL RESOURCES

I will provide all instructional resources at least one week prior to discussion of the material. See bibliography below for specific references.

LAB SCHEDULE

The lab schedule is not firm due to the nature of this course. Lab scheduling will depend on selected individual and class projects, weather, equipment availability, and so forth. However, some of the general lab topics we will cover during the semester described below:

Pond Morphometry: Pond/lake mapping and calculation of physical characteristics including surface area and mean depth.

Water Quality and Habitat Assessment: Analysis of the physiochemical environment.

Community Assessment and Determination of Balance: Identification of species composition and abundance, and analysis of trophic balance between predator and prey complexes.

Trophic Relationships: Quantitative description of the diet of pond fish species and simulation of trophic conditions using bioenergetics modeling.

Biological Statistics: Introduction to important statistical tools in fish management such as relative weight (W_r) and proportional and relative stock density (*PSD*, *RSD*).

Aquatic Plant Identification: Field identification of aquatic plant species and discussion of treatment techniques for problem species.

Lab assignments will be directly related to lab activities, and will usually be integral to class projects. Therefore, although lab assignments are only 15% of the final grade, hard work on lab assignments will reduce effort later in the semester as the class project due date approaches.

SELECT BIBLIOGRAPHY

Aday, D. D., C. M. Kush, D. H. Wahl, and D. P. Philipp. 2002. The influence of stunted body size on the reproductive ecology of bluegill *Leponis macrochirus*. Ecology of Freshwater Fish 11:190-195.

Goodwin, A., J. Jackson, N. Stone, T. Burnley, J. Farwick, and M. Armstrong. *In press*. Farm pond management for recreational fishing. Cooperative Extension Program, University of Arkansas at Pine Bluff. Publication MP-360.

Kohler, C. C., and W. A. Hubert, editors. 1999. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Murphy, B. R., and D. W. Willis, editors. 1996. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

NRCS. 1997. Ponds – Planning, Design, Construction. U.S. Department of Agriculture, National Resource Conservation Service. Agriculture Handbook Number 590. Washington, DC

Swingle, H. S., and E. V. Smith. 1947. Management of farm fish ponds. Agricultural Experiment Station of the Alabama Polytechnic Institute. Bulletin No. 254. Auburn, Alabama.

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Nonparametric Methods in Data Analysis (GAQF 5208)

Session: Summer semester (1st session) of year 2006 (May 30 – June 30)
Credit hours: 2 hours
Time and Location: Woodard 257, MTWF 10:00 AM –11:30 AM
Instructor: Dr. Lin Xie
Office: Woodard Hall, Rm 228
Phone: 870-575-8157
Email: lxie@uaex.edu
Office hours: MW 2:00 PM – 5:00 PM

Prerequisite: GAQF 5405 (Statistics in Research), or equivalent

Course Description
Parametric statistical tests, such as t-test and F-tests, require very rigorous parametric assumptions about the underlying distribution of populations. However, we often deal with data that do not satisfy the restrictive parametric assumptions or sufficient sample size that are crucial for accurate and unbiased statistical inferences. Blind application of parametric testing methods to those data without considerations on population distribution types or sample size requirements is bounded to produce undesired false positive statistical results, which inevitably lead to the unreliable conclusions of the study under investigation. .This course will introduce alternative nonparametric statistical methods that can be used in the analysis of data that does not meet parametric statistical assumptions.

Course Objectives
- Introduce students the concept of parametric and nonparametric assumptions on data.
- To learn the differences between parametric methods and nonparametric methods
- To learn one-sample nonparametric methods
- To learn two-sample nonparametric methods, including permutation test, Wilcoxon Rank-Sum test, Mann-Whitney test, and Kolmogorov-Smirnov test.
- To learn nonparametric contingency table analysis methods, including Mantel-Hanzel Test and McNemar's test.

Instructional Strategy
Class will be a combination of lectures, computer exercises, and in-class discussions for problem solving and data analysis. It is mandatory for the students to read and study the class materials and textbook before coming to class for the preparation of class discussion and for the effective learning. The students will be encouraged to actively take part in the process of problem solving during the lectures. Students will be asked questions to answer and to discuss. Students will be scored based on their performance and participation level for class questions and discussions. Students will be given weekly assignments with data from real world examples that require the knowledge and skill obtained during the class. It will consolidate their understanding of statistical methods and techniques for data analysis they learn from class.

Teaching Model

The class will follow the direct interactive teaching model. In this model, there will be a clear objective for each lesson and students will be challenged to be involved in formulating solutions. The students are encouraged to discuss on the homework assignments with other classmates. Assignments and the tests will be discussed and reviewed in the class to ensure that students digest the knowledge of the topics covered in the class.

Instructional Resources

Required text: Biostatistical Analysis, 4th edition, by Jerold H. Jar, Prentice Hall, 1999.
Computer software: MS Excel, SAS (Ver. 9.1)

Bibliography

Nonparametric Statistical Methods, 2nd Edition, by Myles Hollander and Douglas A. Wolfe, Wiley. 1999.

Practical Nonparametric Statistics, 3rd Edition, by W. J. Conover, Wiley. 1998.

Introduction to Modern Nonparametric Statistics, by James J. Higgins, Duxbury. 2004.

SAS Companion for Nonparametric Statistics, by Scott J. Richter, James J. Higgins, Duxbury 2005.

The Little SAS Book: A Primer, 3rd edition, by Lora D. Delwiche and Susan J. Slaughter, SAS Institute Inc. 2003.

Assignments

There will be 4 weekly assignments (30 points each). The assignments will be comprised of the exercise questions from the text book, and the actual data analysis with real-world examples. Problem solving questions require the detail steps of derivations and procedures to the solution for full points. Data analysis requires the summary of statistical findings and statistical inferences from the analysis as well as test statistics. Although students are encouraged to discuss the assignments, the identical write-ups of solutions will be considered as cheating and no score will be given. Overdue turn-in will automatically reduce 20% from full points for each additional delayed day.

Exams and Grading Policy

There will be 1 midterm exam and one comprehensive final.

Class Participation	100
HW Assignments	120
Mid-term Exam	100
Final Exam	150
Total	470

Grading scale for this class out of full points (470) is:

A: 90-100% (470-418.3), B: 80-89% (418.2-371.3), C: 70-79% (371.2-324.3), D: 60-69% (324.2-277.3), F: 0-59% (277.2-0)

Notes: The exams will be comprised of multiple choices, short answers, and problem solving questions. The exams will be given during regular class hours in the same classroom. All the exams are closed books, however student are allowed to bring a half letter-size sheet for formulas to use during exams. Hand-held calculator is allowed to use during exams. No make-up exam will be given, except emergency situations, such as hospitalization for illness. Class participation will be recorded and scored for the level of understanding and preparation of class materials. Voluntary participation will receive extra credits.

Cheating
No Cheating will be tolerated for the assignments and the exams. Cheating includes copying other students' homework assignment and looking at someone else's answers during exams. Cheating will result in zero score earning in the portion of an assignment or an exam.

Attendance Policy
It is mandatory for students to attend all classes. If any student must miss a class for the reasons of conference attendance, sampling trips, and others, a student must notify the instructor beforehand. The instructor is not responsible to provide class material for missing classes. It is the student's responsibility to make up the missing classes by obtaining the materials from other classmates and self-study.

Cell Phone Policy
Cell phone or any personal communication device should be turned off before entering the classroom. Any student uses such a device during class will be asked to leave class immediately and not to return.

Disability Policy
It is the UAPB policy to accommodate students with disabilities, pursuant to federal law and state law. Any Student who needs accommodations, such as special arrangements for seating and transportation, are encouraged to inform the instructor or contact with Mr. Michael Washington in Caldwell Hall, Room 205, Phone (870) 575-8293, Email: Washington-m@uapb.edu

Course Schedule
Week 1: Introduction on parametric and nonparametric assumptions on data .
Reviews on hypothesis testing (Chap. 6, 7, 8)
Week 2: Two-sample nonparametric tests (Chap. 8)
Week 3: Chi-Square Goodness of Fit tests (Chap. 22) --- Mid-term Exam
Week 4: Contingency Table Analysis (Chap. 23)
Week 5: Sign test, Fisher Exact Test (Chap. 24) --- Final Exam: June 30.

Program Evaluation and Survey Methods (GAQF 5310)

Session: **Spring Even Year**
Time: **MWF 10:00 – 10:50am** OR **6:00 - 9:00pm (See Course Content)**
Room: **Woodard 257**

Instructors:	Madan Dey	Richard Poling
Office:	Woodard 210	State Cooperative Extension Service Office - Little Rock
Telephone:	575-8108	501-671-2084
Email:	mdey@uaex.edu	rpoling@uaex.edu
Office hours:	MWF: 1:00-3:00 p.m.	Available by email.

Course Description

This course will cover the fundamentals of program evaluation and survey methodologies. Evaluation models such as systems analysis, behavioral objectives, and goal-free will be studied. The construction, design, and implementation of questionnaires using a sound scientific approach will be covered in depth.

Course Objectives

1. To introduce students to program development and evaluation.
2. To examine various evaluation models and frameworks.
3. To study various evaluation methods.
4. To examine the survey process for economic, social & market, and biological analysis.
5. To study practical application of program evaluation knowledge and skills.
6. To understand which types of analyses are appropriate for various types of survey data.

Prerequisites

There are no prerequisites for this course.

Instructional Strategies

Instructional strategies and techniques for this course will be combinations of independent study, hands-on projects/activities, and literature-based learning. There will be practical applications and sessions for hands-on survey and program evaluation methods. Students will be encouraged to review and respond to published literature on materials covered in class. Responses will be discussed in class.

Teaching Models

The teaching approach will follow the "Cognitive Apprenticeships Model." This is a graduate class; therefore students should have a heuristic as well as textbook knowledge. This course will teach knowledge and skills in contexts that reflect the way the knowledge will be useful in real-life situations. We will explain concepts to show how to plan Extension/Non-Formal education processes and how to develop and evaluate programs in the context of socio-economics and biological processes in aquaculture and natural resources settings. Students will complete tasks independently but instructor(s) will provide hints and support when needed.

Instructional Resources

There is no text for this course. However, students are encouraged to read all the course references as well as the reading assignments given in class. Students will be given outlines for reading prior to covering the material in class.

Course Content

	Material to be covered	**Instructor**
Week 1	Introduction, distribution of syllabus, discussion of class schedules for Program Evaluation Session/Planning and Conducting a Survey	Dr Dey
Week 2	Survey types/uses (for economic analysis, social & market analysis, biological analysis)	Dr Dey
Week 3	Data collection Methods (secondary & primary); Surveys	Dr Dey
Week 4	Sampling (theory, methods, sample size determination, etc)	Dr Dey
Week 5	Sampling (theory, methods, sample size determination, etc)(Cont.) **(Assignment 1)**	Dr Dey
Week 6	Questionnaire design, development & implementation	Dr Dey
Week 7	Questionnaire design, development & implementation (Cont.)	Dr Dey
Week 8	Questionnaire design, development &	Dr Dey

	implementation (Cont.) (**Assignment 2)**	
Week 9	Survey data analyses	Dr Dey
Week 10	Survey data analyses	Dr Dey
	Spring Break	
Week 12	Evaluation in the Program Planning Process	Dr Poling
Week 13	Evaluation Models and Frameworks **(Assignment 3)**	Dr Poling
Week 14	Developing an Evaluation Plan	Dr Poling
Week 15	Evaluation Methods **(Assignment 4)**	Dr Poling
Week 16	Interpreting and Reporting Evaluation Data; Practical Application of Program Evaluation Knowledge and Skills	Dr Poling
	Class Presentations	Drs Poling, Dey
	FINAL EXAMS	

Assignments

There will be 4 assignments in this class, a mid-term exam, final exam and a term project.

Assignment 1: Design of a survey and sampling procedure
Assignment 2: Development of survey instrument
Assignment 3: A 1-2 page critical review of a journal article/professional meeting presentation related to program evaluation.
Assignment 4: Conduct an interview with a non-formal education program educator or administrator related to evaluation of programs. An interview guide, discussion of the interview procedures and a list of suggested interviewees will be provided in class. Results from the interviews will be discussed in class.

Term Project

Each student will be required to pursue a class project that is relevant to his/her thesis focus. The project should relate to evaluation of a specific program by a natural resource agency, non-formal education organization, farmer organizations, state agency, etc. Students should discuss their class projects with the instructors before starting the project.

Hints
Develop and present an evaluation plan for a "real-life" program related to the student's area of interest. The project will include and address the major components of an evaluation plan outlined in class.

Outline
a. Outline of program to be evaluated
b. Objectives of project
c. Evaluation method(s) used
d. Results/Discussion

Grading
a. Completeness (plan includes and adequately addresses major components of an evaluation plan that includes the 4 factors above)
b. Does the plan address the evaluation standards (Utility, Feasibility, Propriety and Accuracy)?
c. Clarity of writing (understandability, grammar, spelling, etc.)
d. Oral presentation (clarity, use of media, etc.)

Grading Policy

Assignments - 4 @ 25 points each		100
Mid-term exam		50
Final exam		80
Term Project		50
	Class presentation	**10**
	Class participation	**10**
	Total	**300**
Grade		
A		270 – 300
B		240 – 269
C		210 – 239
D		180 – 199
E		0 – 179

Cheating

Cheating will not be tolerated. Cheating includes copying someone else’s homework, using “cheat sheets” in class, looking at someone else’s answers during a quiz or an exam, etc. Anyone caught cheating will receive a “0” on that exam, quiz, or paper.

Student with Disabilities

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University’s commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veteran Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

Class Attendance Policy

The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

11. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

12. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

13. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.

14. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

15. An additional three (3) unexcused absences beyond those in #4 will result in an automatic “F” awarded to that student in the class.

Instructor Attendance

The spring is when many professional meetings are scheduled. As part of their professional development instructors will be required to attend some of these meetings. However, no class will be cancelled during the instructor’s absence. Students will have a guest speaker, in-class/lab exercises or exams in cases where the instructor is away for a meeting.

Textbook/Reading materials

There is no specific textbook for this class. Reading materials will be provided in class. However, the following are very good reference materials and students are encouraged to consult them.

Program Development & Evaluation

1. Program Development and Evaluation Resources. (http://www.ca.uky.edu/agpsd/soregion.htm) A project of the Extension Program and Staff Development Committee of the Southern Region Program Leadership Network.
2. Evaluating Extension Program Outcomes, Richard L. Poling (http://web.utk.edu/~aee/accountability.htm).
3. Writing Extension Impact Statements, Richard L. Poling (http://web.utk.edu/~aee/accountability.htm).
4. Program Evaluation Tipsheets, (http://www.extension.psu.edu/evaluation/) Pennsylvania State University Cooperative Extension and Outreach.
5. Education Through Cooperative Extension, Brenda Seevers, Donna Graham, et al.
6. Planning Better Programs, Patrick G. Boyle.
7. Qualitative Evaluation and Research Methods, Michael Quinn Patton
8. Practical Evaluation, Michael Quinn Patton

Survey Method

1. Mail and Internet Survey: The Tailored Design Method, Second Edition, Don A. Dillman
2. The Survey Research Handbook, Pamela L. Alreck, Robert Settle, Robert G. Settle
3. Creel and Angler Surveys in Fisheries Management, D. Guthrie et al.,
4. Angler and Survey Methods and Their Applications in Fisheries Management, K. H. Pollock, C. M. Jones, and T. L. Brown
5. State of the Art Marketing Research, A.B. Blankenship, G. E. Breen & A. Dutka
6. Maddala, G.S. Limited-Dependent and Qualitative Variables in Economics, Cambridge University

Quantitative Methods in Fisheries and Aquaculture Economics
Aquaculture/Fisheries (GAQF) 5324
University of Arkansas at Pine Bluff
Spring semester, 2009

INSTRUCTOR: Dr. Madan M. Dey
Office: Woodard Hall, Rm 221
Office phone: 870-575-8108
Fax: 870-575-4637
E-mail: mdey@uaex.edu

CLASS TIMES: Monday/Wednesday/Friday 10:00-10:50 am in Woodard Hall Room 257
Turn cell phones and pagers off during ***all*** class activities.

OFFICE HOURS: 1:00pm-3:00pm, Monday/Tuesday/Wednesday

Other hours by appointment. Feel free to email or call me anytime. If I am unavailable, I will return your call as soon as possible provided you let me know when/where you can be reached.

PREREQUISITE: None

Course Objectives

1. To introduce students to applied economics in aquaculture and fisheries;
2. To examine economic principles relating to preferences and demand for market and non-market goods and services;
3. To engage in quantitative analyses and methods in natural fisheries and aquaculture marketing;
4. To utilize various valuation methods for specific non-market goods and services;
5. To study marketing research methodologies for market and non-market goods and services;
6. To utilize modeling techniques and estimation procedures.

Prerequisites: There are no prerequisites for this course.

Instructional Strategies

Instructional strategies and techniques for this course will be combinations of independent study, hands-on projects/activities, computer modeling, and literature-based learning. There will be computer lab sessions for hands-on modeling. Students will be encouraged to respond to published literature on materials covered in class to promote the active construction of meaning to economic and modeling concepts.

Teaching Models

Teaching approach will follow the "Cognitive Apprenticeships Model," an instructional model derived from the metaphor of the apprentice working under the master craftsperson in traditional societies, and from the way people seem to learn in everyday informal environments. This is a graduate class; therefore students should have a heuristic knowledge as well as textbook knowledge. This course will teach knowledge and skills in contexts that reflect the way the knowledge will be useful in real-life problem-solving situations. We will model and explain concepts to show how economic processes unfold and reasons why they happen that way in the context of aquaculture and fisheries. Students will complete tasks independently but instructor will provide hints and support when needed.

Recommended Text Book

There is no textbook that adequately covers all the aspects of this class. The following books are recommended. All these books are available in the Aquaculture/Fisheries Library.

Coelli, T.J., R. S. P. Rao, C. J. O'Donnell, and G.E. Battese. 2005. An Introduction to Efficiency and Productivity Analysis. Springer. (2nd edition) (Recommended)

Deaton, Angus and John Muellbauer. 1980. Economics and Consumer Behavior. Cambridge University Press. 1980 (Optional)

Franses, P. H., and R. Paap. 2007. Quantitative Models in Marketing Research. Cambridge University Press. (5th printing) (Required)

Grafton, R.Q., W. Adamowicz, D. Dupont, H. Nelson, Robert J. Hill, and S. Renzetti. 2004. The Economics of the Environment and Natural Resources. Blackwell Publishing (Recommended)

Course Content

Part I: Overview of Consumption and Demand Analysis

Unit 1. Overview of consumer theory

The purpose of this section is to lay the foundation for a sound understanding of the basic tools of consumer preference analysis. Concepts and theory that will be discussed include axiomatic description of consumer preferences, derivation and properties of demand functions, duality theory, expenditure, indirect utility functions, and separability and aggregation of preferences.

Unit 2: Functional Forms and Demand System Specification
This unit will examine functional forms and demand system specification and estimation of demand systems. We will briefly cover different functional forms of demand functions including the Linear Expenditure System, Rotterdam Model, and Almost Ideal Demand System. Examples from the seafood demand literature will be studied.

Unit 3. Lancaster approach to demand theory
The focus of this topic will be on the demand for characteristics and the derived demand for market and non-market goods. The applicability of this concept to the analysis of quality characteristics, household production theory, and random utility theory to formulate demand functions will be examined. The integration of household production theory into the theory of consumer behavior will be also examined. Applications of Lancaster approach in seafood demand will be reviewed.

Part II: Overview of Production Economics

Unit 4. Overview of Theory of the Firm
We will briefly cover the economic theory of the producer/firm. Concepts that will be discussed include production functions, profit functions, cost function, revenue functions, and the derivation of factor demand and output supply functions. Functional forms in empirical analysis will be discussed. Examples from aquaculture and fisheries economics literature will be reviewed.

Unit 5. Index Numbers and Productivity Measurements
The discussion will focus on Index Number approaches to measuring productivity. Special emphasis will be given on total factor productivity (TFP) analysis. We will review recent applications of Index Number approach in aquaculture and fisheries.

Unit 6. Technical, Allocative and Economic Efficiency
This unit will provide an overview of various efficiency concepts, and will examine various approaches to the estimation of efficiency (including Stochastic Production Function Approach and Data Envelopment Analysis). We will review empirical studies dealing with efficiency in Aquaculture and natural resource fisheries.

Part III: Economics of the Environment and Natural Resources

Unit 7. Theory of Public Goods and Environmental Valuation
This unit will begin with a brief overview of various types of goods (i.e., private goods, public goods and common-pool resources). Issues relating to public goods and externalities will be discussed. Theoretical foundation of environmental valuation will also be discussed.

Unit 8. Environmental Valuation: Stated Preference Method
This unit will examine the basic economic and econometric issues associated with stated preference methods and will focus on two major stated preference variants: contingent valuation method and choice experiments. Applications of stated preference method in natural fisheries will be studied.

Unit 9. Environmental Values Express through Market Behaviour
This unit will focus on various revealed preference methods, such as hedonic, travel cost, and willingness-to-pay and willingness-to-accept measures. Examples from fisheries economics literature will be studied.

Unit 10. Bioeconomic models of Natural Fisheries
In this unit we will analyze economic models that explain and predict the stylized facts about capture fisheries.

Part IV: Quantitative model for preference data

Unit 11. Econometric Modeling of Continuous Depending Variable
In this unit we will discuss the standard Linear Regression model, which can be useful for a continuous dependent variable. We will cover Ordinary Least Squares (OLS) and Maximum Likelihood (ML) estimation methods

Unit 12. Econometric Modeling of binomial Depending Variable
This unit will cover the binomial Logit and Probit models. We will discuss the ML estimation method and will provide some relevant model diagnostics and evaluation criteria. Application of Logit/Probit models in seafood consumption will be reviewed.

Unit 13. Econometric Modeling of multinomial Depending Variable
This unit will deal with both ordered and unordered multinomial dependent variables. We will focus on quite a number of models, including Multinomial Logit Model, Multinomial Probit Model, Nested Logit Model, Conditional Logit model, Ordered Probit Model, Ordered Logit Model. Application of these models in seafood sector will be reviewed.

Unit 14. Truncated and Censored Regression Model
This unit will deal with dependent variables that are partly continuous and partly take some fixed value or are partly unknown. We will mainly focus on the Truncated Regression Model and on the Type-1 and Type-2 Tobit models.

Part V Optimization and Fish/Seafood Sectoral models

Unit 15. Programming Models
This unit deals with linear programming, Quadratic Programming and Non-linear Programming Models. Application of Programming Models is aquaculture will be reviewed.

Unit 16. Economic Models for Fish/Seafood Sector
This unit will provide a brief overview of various economic impact models (e.g., Input-Output Model, Econometric Model and CGE model) used in fish/seafood sector.

Assignments

There will be five (5) assignments in this class. Assignments will include lab exercises. Assignments will be distributed throughout the course, approximately proportionally to the time spent on the five course components.

Grading Policy

Assignments – 5 @ 40 points each	200
Mid-term exam	100
Final exam	170
Class participation	30
Total	**500**

Grade

A	450 – 500
B	400 – 249
C	350 – 399
D	300 – 349
F	0 – 300

STUDENT WITH DISABILITIES

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veteran Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

CLASS ATTENDANCE POLICY

The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

16. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

17. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

18. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.

19. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

20. An additional three (3) unexcused absences beyond those in #4 will result in an automatic "F" awarded to that student in the class.

INSTRUCTIONAL RESOURCES

Students are encouraged to read all the course references as well as the reading assignments given in class. Additional materials will be provided periodically from other resources.

UNIT	READING ASSIGNMENTS
1	Deaton and Muellbauer (1980), Chapters 1 and 2 Deaton (1986)
2	Asche *et al.* (2007) Deaton (1986) Deaton and Muellbauer (1980), Chapter 3 Dey et al. (2008)
3	Deaton and Muellbauer (1980), Ch 10 Lancaster (1966) Ladd and Suvannunt (1976)
4	Coelli et al. (2005), Ch 2 Jensen (2002)
5	Coelli et al. (2005), Ch 3 and 4 Gordon et al. (2008)
6	Coelli et al. (2005), Ch 6 and 9 Dey et al. (2005a) Sharma and Leung (2003)
7	Grafton et al. (2004), Ch 8
8	Grafton et al. (2004), Ch 9
9	Grafton et al. (2004), Ch 10
10	Grafton et al. (2004), Ch 4

	Nostbakken and Bjorndal (2003)
11	Franses and Paap (2007), Ch 3
12	Franses and Paap (2007), Ch 4
13	Franses and Paap (2007), Ch 5 and 6
14	Franses and Paap (2007), Ch 7
15	Any undergratuate text book on Applied Mathematicall Programing
16	Briones (2006) Dey et al (2005b) Seung and Waters (2006)

Bibliography and Reading Materials

Asche, F., T. Bjorndal and D. Gordon. 2007. Studies in the demand structure for fish and seafood products, in Weintraub, A., Romero, C., Bjorndal, T. and Epstein, R. (eds), *Handbook of Operations Research in Natural Resources*. Springer, pp 295-314

Coelli, T.J., R. S. P. Rao, C. J. O'Donnell, and G.E. Battese. 2005. An Introduction to Efficiency and Productivity Analysis. Springer. (2nd edition)

Deaton, A. 1986. Demand Analysis. In: Z Griliches and M.D. Intriligator (eds.) Handbook of Econometrics, Vol III, Elsevier Science Publishers.

Deaton, Angus and John Muellbauer. 1980. Economics and Consumer Behavior. Cambridge University Press.

Dey, M.M., F.J. Paraguas, X. Yuan, N. Srichantuk, R. Bhatta and L.T.C. Dung. 2005a. Technical efficiency of fish farming under polyculture system in freshwater pond in Asia: a cross-country comparison. *Aquaculture Economics and Management*, vol 9 (no. 1&2): 39-64.

Dey M. M., Briones R. and Ahmed M. 2005b. Disaggregated Analysis of Fish Supply, Demand and Trade in Asia: Baseline Model and Estimation Strategy. *Aquaculture Economics and Management*, 9(1/2), 113-140,

Dey M.M. and Y.T. Garcia with Kumar P, Piumsombun S, Haque MS, Li L, Radam A, Senaratne A, Khiem NT, Koeshendrajana S. 2008. Demand for fish in Asia: A cross-country analysis. *The Australian Journal of Agricultural and Resource Economics,* 51: 321–338

Franses, P. H. and R. Paap. 2007. Quantitative Models in Marketing Research. Cambridge University Press. (5th printing)

Gordon, D., T. Bjorndal, M.M. Dey and R.K. Talukder. 2008. Production characteristics of shrimp farming in Bangladesh: an index approach. Marine Resources Economics, 23(4)

Grafton, R.Q., W. Adamowicz, D. Dupont, H. Nelson, Robert J. Hill, and S. Renzetti. 2004. The Economics of the Environment and Natural Resources. Blackwell Publishing

Jensen, C. L. 2002 Applications of Dual Theory in Fisheries: A Survey. *Marine Resources Economics*, 17:309-334, 2002.

Lancaster, K. J. 1966. A New Approach to Consumer Theory." *Journal of Political Economy*, 74: 132-157.

Ladd, G.W. and V. Suvannunt. 1976. A model of consumer goods characteristics. *American Journal of Ag Economics*, 58:505-510.

Nostbakken, L. and T. Bjorndal. 2003. Supply functions for North Sea herring. *Marine Resources Economics*, 18: 345-361

Sharma, K.R. and Leung, P.S. 2003. A review of production frontier analysis for aquaculture management. *Aquaculture Economics and Management*, 7(1&2), 15–34.

RESEARCH METHODS AND SCIENTIFIC WRITING (GAQF 5300)
Spring 2009

Principal Coordinator: Madan M Dey

Instructors:

C. Engle	(870) 575-8523	cengle@uaex.edu
M. Eggleton	(870) 575-8100	meggleton@uaex.edu
A. Goodwin	(870) 575-8137	agoodwin@uaex.edu
A. Haukenes	(870) 575-8105	ahaukenes@uaex.edu
A. Kelly	(510) 676-3124	akelly@uaex.edu
R. Lochmann	(870) 575-8124	rlochmann@uaex.edu
S. Lochmann	(870) 575-8165	slochmann@uaex.edu
M. Dey	(870) 575-8108	mdey@uaex.edu
P. Perschbacher	(870) 575-8145	pperschbacher @uaex.edu

Office: Woodard Hall, Rm 221

Office Hours: 1:00pm-3:00pm, Monday/Tuesday/Wednesday

Telephone (Office): 870-575-8108

E-mail: mdey@uaex.edu

Class time & Location: Lecture**:** MW 9:00-9:50 a.m. Woodard 257
Lab: W 2:00-3:50 p.m. Woodard 257

TEXTBOOKS: Day, R.A. 1998. How to Write & Publish a Scientific Paper. Oryx Press, Phoenix, Arizona.

COURSE DESCRIPTION: Students will learn general principles of scientific writing and how to conduct literature searches. Different formats of written communications pertinent to aquaculturists and fisheries biologists will be examined. The main objective of this course is to enable students to convey research results effectively through written and oral communications.

CLASS STRUCTURE: Madan Dey will be serving as principal coordinator for the class, but will draw upon the considerable diversity of expertise in our department as it relates to different types of research methods and writing. Instructors for the various topics will grade the corresponding assignments.

You are urged to read the assignments prior to arriving in class. Class time will be spent in discussion of the reading material and on problem-solving exercises related to the issues covered in the readings.

PREREQUISITES

There are no prerequisites for this class.

COURSE OBJECTIVES

1. To be able to write technical scientific material in a clear, concise, and precise manner.

2. To be able to organize data efficiently in laboratory notebooks and in electronic files.

3. To be able to correctly place information into introduction, literature review, methods, results, discussion, and conclusion sections of a journal-quality manuscript.

4. To select the most appropriate primary sources of literature to cite and to know the relevance of the work cited.

5. To present high-quality scientific and stakeholder presentations.

6. To uphold high standards of scientific integrity and maintain high ethical standards.

COURSE OUTLINE & SCHEDULE

Date	Day	Topic	Instructor
Jan. 12	(M)	Syllabus Handout Introduction Overview of term paper assignment Issue of plagiarism in scientific writing	M. Dey
Jan. 14	(W) Lec	Why do research, expected outcomes of research: new knowledge for: 1) scientific community, 2) stakeholders; deliverable outputs appropriate for each	C. Engle
Jan 14	(W) Lab	Critical review of sentence structure	A. Kelly
Jan. 19	(M)	Martin Luther King, Jr. Holiday Observed (no classes)	

Jan. 21	(W) LEC	Authorship, scientific integrity: Professionals must follow principles of integrity and understand the property and intellectual rights associated with research and the implications for authorship.	C. Engle
Jan. 21	(W) LAB	Writing a biosketch	A. Kelly
Jan. 26	(M)	Basics of technical writing: Scientists must be able to write clearly, concisely, and precisely to communicate successfully, publish in the scientific literature, and to be successful in obtaining external grant funding.	R. Lochmann
Jan. 28	(W) LEC	Basics of technical writing (cond)	R. Lochmann
Jan. 28	(W) LAB	Basic technical writing skills	R. Lochmann
Feb. 2	(M)	Basics of technical writing (cont.)	R. Lochmann
Feb. 4	(W) LEC	Literature review: literature searches, sources of literature, selection of most important references	P. Perschbacher
Feb. 4	(W) LAB	Basics technical writing skills (cont.)	R. Lochmann
Feb. 9	(M)	Literature review (cont.)	P. Perschbacher
Feb. 11	(W) Lec	Writing literature reviews: knowing relevance of studies to what they are writing about. Scientists must have a thorough understanding of how their research fits within the known body of knowledge (the scientific literature) in the respective field.	P. Perschbacher
Feb. 11	(W) LAB	Composition of an outline for a paper	P. Perschbacher
Feb. 16	(M)	Ethics: Professionals must follow principles of ethics if they are to be successful over time.	C. Engle

Feb. 18	(W) Lec	Writing introductions: Students must be able to write clear, concise, complete, precise introduction sections of scientific papers. Good & bad examples will be compared.	P. Perschbacher/ M. Eggleton
Feb. 18	(W) LAB	Writing an Introduction	P. Perschbacher/ M. Eggleton
Feb. 23	(M)	Writing introductions (Cont.)	P. Perschbacher
Feb. 25	(W) LEC	Record-keeping/electronic files/lab. Notebooks Students need to be able to organize data efficiently in laboratory notebooks and in electronic files and understand Good Laboratory Practices	A. Goodwin
Feb. 25	(W) LAB	Writing an Introduction	P. Perschbacher
March 2	(M)	Writing Methods Students must be able to write clear, concise, complete, precise methods sections of scientific papers.	A. Goodwin
March 4	(W) Lec	Writing Methods (Cont.)	A. Goodwin
March 4	(W) Lab	Writing Methods	A. Goodwin
Mar 9	(M)	Writing Results Students must be able to write clear, concise, complete, precise results sections of scientific papers.	A. Kelly
March 11	(W) Lec	Writing Results (Cont.)	A. Kelly
March 11	(W) Lab	Writing Results	A. Kelly
Mar. 16	(M)	Presenting experimental data in Results: ponds & tanks	R. Lochmann

Mar. 18	(W) Lec	Presenting data in results sections: Natural Fisheries	S. Lochmann
Mar. 18	(W) Lab	Writing Results- Tables and Figures	S. Lochmann
March 23-27		SPRING BREAK	
Mar. 30	(M)	Presenting data in results sections: economics and social sciences	M. Dey
April 1	(W) Lec	Writing discussions & conclusion Students must be able to write clear, concise, complete, precise discussion sections of scientific papers.	A. Haukenes
April 1	(W) Lab	Writing discussion and conclusion	A. Haukenes
Apr. 6	(M)	Writing discussions & conclusions (Cont.)	A. Haukenes
Apr. 8	(W) Lec	Presenting scientific papers	S. Lochmann
Apr. 8	(W) LAB	Presentation preparation	S. Lochmann
Apr. 13	(M)	Presentations to stakeholder groups	A. Goodwin
Apr. 15	(W) Lec	a) Publications process: selecting a journal, reading other articles in journal, style & format, submission, reviews, responses to reviewers' comments b)Writing grant proposals Students need to be able to select an appropriate journal or funding agency and follow all appropriate deadlines, guidelines, and formats to maximize chances for success for acceptance or funding.	C. Engle
Apr. 15	(W) Lab	Manuscript submission: writing an abstract and submission letter	C. Engle
Apr. 20	(M)	Fish handling & fish welfare Aquaculture/fisheries students must practice good fish handling techniques to minimize stress to fish and to follow established principles of animal welfare.	C. Engle

Apr. 22	(W) Lec	Job search, resume writing, job applications, interview skills	M. Eggleton
April 22	(W): Lab	Publication process Summary: contending with review's comments	S. Lochmann
Apr. 27	(M)	Student presentations & peer evaluations Students must be able to make effective presentations at both scientific meetings and with stakeholder groups.	S. Lochmann/ A. Goodwin
Apr. 29	(W) Lec	Student presentations & peer evaluations	S. Lochmann/ A. Goodwin
Apr. 29	(W) Lab	Writing a job application letter and Resume	M. Eggleton

TERM PAPER WRITING ASSIGNMENT

Students are required to write a double-spaced 8 to 10 page long (not counting figures, tables, and bibliography section pages) paper on a subject of their choice. Students can choose a topic that is related to their own research project. The first writing draft should be turned in by the end of third week of class (Jan. 28). The first draft will not be graded. However, students must improve their first writing as class progresses. The final writing must contain all the essential aspects and formats in each section that are instructed through the class. Students also need to write a double-spaced 2-3 page of summary of the comparisons between their first writing and the final writing to measure how much their scientific writing skill has improved. The final writing and the summary will be graded, and must be turned in by April 22 (one week prior to the final week).

TEACHING MODEL

Basic information will be presented in the reading materials for this course. Class time will be spent discussing the material, comparing examples of well- and poorly-written papers, frequent but short writing exercises, and class presentations with peer evaluations. Writing assignments will be reviewed by class peers prior to submission.

INSTRUCTIONAL STRATEGIES

Students will have the information presented in the reading materials reinforced in the classroom through active discussion of applications with analysis and review of real-world examples and periodic writing assignments.

GRADING

Assignments		Points	Graded by:
1.	Introduction	50 points	P. Perschbacher
2.	Literature review	50 points	P. Perschbacher
3.	Methods	50 points	A. Goodwin
4.	Results	50 points	A. Kelly
5.	Discussion	50 points	A. Haukenes
6.	Scientific presentation	50 points	S. Lochmann
7.	Stakeholder presentation	50 points	A. Goodwin
8.	Lab assignments	100 points	All Instructors
9.	Term Paper	100 points	A. Haukenes/M.Dey
TOTAL		550 points	

Lab Assignments (Breakdown)		Points	Graded by:
i.	Sentence structure/Bio	15 points	A. Kelly
ii.	Basic technical writing skill	20 points	R. Lochmann
iii.	Outline/Introduction	15 points	P. Perschbacher
iv.	Methods	15 points	A. Goodwin
v.	Results	20(10+10) pts	A. Kelly/S. Lochmann
vi.	Discussion and conclusion	15 points	A. Haukenes
SUB-TOTAL		100 points	

Final Grade	Points Required
A	550-495 points
B	494-440 points
C	439-385 points
D	384-330 points
F	< 330 points

CLASS ATTENDANCE POLICY

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21. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

22. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

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25. An additional three (3) unexcused absences beyond those in #4 will result in an automatic "F" awarded to that student in the class.

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EXTRA HELP

We are available for extra help during office hours, by appointment, and any time that we are in our offices. However, it is best to make an appointment if you need to see an instructor. If you do not understand something after reading the materials and participating in class, come see us. It is up to you to keep up and you must bring your questions to us.

STUDENTS WITH DISABILITIES

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veteran Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

INSTRUCTIONAL RESOURCES AND BIBLIOGRAPHY

These materials are on reference file in the Aquaculture/Fisheries Library

Beynon, R.J. 1993. Postgraduate Study in the Biological Sciences: A Researcher's Companion. Portland Press, London.

Davis, M. 1997. Scientific Papers and Presentations. Academic Press, New York, New York.

Day, R.A. 1998. How to Write & Publish a Scientific Paper. Oryx Press, Phoenix, Arizona.

Ebel, H.F., C. Bliefert, and W.E. Russey. 1990. The Art of Scientific Writing. VCH Publishers, New York, New York.

Macrina, F.L. 2000. Scientific Integrity: An Introductory Text with Cases. 2nd edition. ASM Press, Washington, D.C.

Smith, R. 1998. Graduate Research: A Guide for Students in the Sciences. 3rd edition. University of Washington Press, Seattle, Washington.

Statistics in Research (GAQF 5405)

Session: Fall 2006
Time: MWF 11:00 – 12:15 AM
Location: Woodard Hall 257

Instructor: Dr. Lin Xie
Office: Woodard Hall, Rm 228
Phone: 870-575-8157
Email: lxie@uaex.edu
Office hours: TBA

Prerequisite: College Algebra

Course Description
This course will cover the fundamentals of basic statistics and analytical techniques that are needed for scientific research data analysis. The statistics taught in this class will range from descriptive statistics, simple t-tests, ANOVAs, to linear regression. Theories and applications of statistics will be dealt with real-world examples.

Course Objectives

- Introduce students the meaning and role of statistics in science.
- To study the concept of population, sample, parameters, and estimators
- To study basic probability theory and types of statistical distributions.
- To study the methods of data exploration and data visualization.
- To study the methods of descriptive statistics.
- To study the various statistical tools for data analysis, including t-tests, ANOVAs, correlation analysis and linear regression.
- At the end of class, students will be equipped with statistical knowledge and techniques that are needed for their research data analysis.

Instructional Strategy
Class will be a combination of lectures and computer labs for problem solving and data analysis. The students will be encouraged to actively take part in the process of problem-solve during the lectures. Students will be given weekly assignments with data from real world examples that require the knowledge and skill obtained during the class. It will consolidate their understanding of statistical methods and techniques for data analysis they learn from class.

Teaching Model
The class will follow the direct interactive teaching model. In this model, there will be a clear objective for each lesson and students will be challenged to be involved in formulating solutions. The students are encouraged to discuss on the homework assignments with other classmates. Assignments and the tests will be discussed and reviewed in the class to ensure that students digest the knowledge of the topics covered in the class.

Instructional Resources
Required text: Biostatistical Analysis, 4th edition, by Jerold H. Jar, Prentice Hall
Computer softwares: Excel, Minitab

The book, "Biostatistical Analysis" will be used as the main text book in this class. To solve the problems and analyze the data, Excel and Minitab will be used as computing tools.

Some files for class hand-outs including HW assignments, presentations, and Excel demos will be available in my department shared folder, \\aqfi-lab1\YLEE\GAQF5405_2006\. If you type in "catfish" for the password, you should be able to read and copy the files to your local drive.

Bibliography
Mathematical Statistics with Applications, 1995, 5th edition, by Dennis Wackerly, William Mendenhall, and Richard L. Scheaffer, Duxbury

Assignments
There will be 7 assignments (20 points each), which will be given in every other Wednesday class. The assignments are due until the following Wednesday class. The assignments will be comprised of the exercise questions from the text book, and the actual data analysis with real-world examples. Problem solving questions require the detail steps of derivations and procedures to the solution for full points. Data analysis requires the summary of statistical findings and statistical inferences from the analysis as well as test statistics. Although students are encouraged to discuss the assignments, the identical write-ups of solutions will be considered as cheating and no score will be given. Overdue turn-in will automatically reduce 20% from full points for each additional delayed day.

Exams and Grading Policy
There will be 2 midterm exams and one comprehensive final.

Mid-term Exam1	100
Mid-term Exam2	100
Final Exam	160
HW Assignments	140
Total	500

Grading scale for this class out of full points (500) is:

A: 90-100% (500-450), B: 80-89% (449-400), C: 70-79% (399-350),
D: 60-69% (349-300), F: 0-59% (299-0)

Notes: The exams will be comprised of short answers and problem solving questions. The midterm exams will be given during regular class hours in the same classroom. All the exams are closed books, however students are allowed to bring a half letter-size sheet for formulas to use during exams. Hand-held calculator is allowed to use during exams. No make-up exam will be given, except emergency situations, such as hospitalization for illness.

Cheating
No Cheating will be tolerated for the assignments and the exams. Cheating includes copying other students' homework assignment and looking at someone else's answers during exams. Cheating will result in zero score earning in the portion of an assignment or an exam.

Attendance Policy
It is mandatory for students to attend all classes. If any student must miss a class for the reasons of conference attendance, sampling trips, and others, a student must notify the instructor beforehand. The instructor is not responsible to provide class materials for missing classes. It is the student's responsibility to make up the missing classes by obtaining the materials from other classmates and self-study.

Cell Phone Policy
Cell phone or any personal communication device should be turned off before entering the classroom. Any student uses such a device during class will be asked to leave class immediately and not to return.

Disability Policy
It is the UAPB policy to accommodate students with disabilities, pursuant to federal law and state law. Any Student who needs accommodations, such as special arrangements for seating and transportation, are encouraged to inform the instructor or contact with Mr. Michael Washington in Caldwell Hall, Room 205, Phone (870) 575-8293, Email: Washington-m@uapb.edu

Course Schedule

Week	Dates	Sections	Material
1	Aug. 28-Sep. 1	Chap. 1, 2	Intro: Types of data, Population & Samples
2	Sep. 4-8	Chap.3	Measures of Central Tendency
3	Sep. 11-15	Chap.4	Measures of Dispersion and Variability
4	Sep. 18-22	Chap.5	Probabilities

5	Sep. 12-16	Chap. 6	Normal Distribution
6	Sep. 25-29	Chap. 7	One Sample Hypothesis
7	Oct. 2-6	Chap. 8, 9	Two Sample t-tests Paired-Sample t-tests
8	Oct. 9-13	Chap. 10	Multi-Sample Hypotheses
9	Oct. 16-20	Chap. 13	Data Transformations <u>(Midterm Exam 1)</u>
10	Oct. 23-27	Chap. 11	Multiple Comparisons
11	Oct. 30- Nov. 3	Chap. 12	Two-Way ANOVA
12	Nov. 6-10	Chap. 19	Correlation
13	Nov. 13-17	Chap. 17	Linear Regression <u>(Midterm Exam 2)</u>
14	Nov. 20-24	Chap. 17	Linear Regression
15	Nov. 27- Dec. 1	Chap. 17	Linear Regression
16	Dec. 4-8	Final Week	<u>Final Exam</u>

Stream Ecology (GAQF 5445)

Instructor: Dr. Michael Eggleton | **Office Hours:** TU, TH 1-3; WE 10-11

Telephone: (870) 575-8100 office | **Class time:** 9:30-10:45 a.m. TU, TH
Lab: WE 2-5 p.m.

E-mail: meggleton@uaex.edu

COURSE DESCRIPTION: Students will learn about the chemical, physical, and biotic factors that affect stream organisms and will learn how ecosystems function. Stream habitat management, impact assessment, and habitat modeling will be emphasized. Hydrological data interpretation will be integrated into field exercises. This course is recommended to acquire an understanding of stream hydrology and dynamics.

TEXT REQUIRED: Allan, J. D. 1995. Stream ecology: structure and function of running waters. Kluwer Academic Publishers, London.

OPTIONAL TEXTS: Hauer, F. R., and G. A. Lamberti. 1996. Methods in stream ecology. Academic Press, San Diego.

Giller, P. S., and B. Malmqvist. 1998. The biology of streams and rivers. Oxford University Press, Oxford.

Cushing, C. E., and J. D. Allan. 2001. Streams: their ecology and life. Academic Press, San Diego.

PREREQUISITES: None

EQUIPMENT: Students will need waders. I highly recommend you buy or bring your own pair, although older waders are available if you choose not to.

CLASS STRUCTURE: Students must read all assignments prior to arriving in class. Class time will be spent in discussion of the reading material, presentation of formal lectures, problem-solving exercises related to the issues covered in the readings, and on application of the information to analyses that you will develop in the laboratories.

TEACHING MODEL

Information will be presented in multiple formats for this course, including digital and hardcopy reading materials, videos, Internet sites, PowerPoint lectures, and various other medias. Class time will be spent discussing the material, working on solving problems related to the reading materials, and presentations of real-world examples.

INSTRUCTIONAL STRATEGIES

This course will utilize both critical thinking and hands-on approaches. Lectures will involve group discussions to stimulate students in learning complex concepts, and laboratory exercises will provide on-site learning opportunities.

COURSE OBJECTIVES

1. To understand rivers as dynamic physical entities and to be able to classify rivers based on size, flow, shape, etc.

2. To understand how abiotic factors influence the stream environment and the organisms that depend upon it.

3. To describe and explain sources of energy in streams, including instream production, inputs from terrestrial sources, and the role of organic matter.

4. To discuss the feeding roles and food webs of plants and organisms in stream ecosystems, and the structural and functional ecology of riverine ecosystems.

5. To discuss the types and distributions of river systems in the U.S. and elsewhere.

6. To understand current paradigms used to describe how river systems function (e.g., the River Continuum Concept, Flood-Pulse, etc.)

7. To describe trends in the management, conservation, and restoration of rivers.

CLASS PROJECTS

There will be several class projects in association with laboratory exercises during the course of the semester. In addition, each student will be responsible for individual projects that will be completed and presented at the end of the semester. Specific project formats and topics will depend upon individual student research interests, but the general topic selection must be compatible with the study of streams. Some laboratory exercises may be directed towards individual projects, but students are expected to conduct much of their research on their own. More extensive weekend sampling trips may be arranged if needed. More information on individual projects will be given early in the semester.

ATTENDANCE

You are now professionals and are expected to attend every class. This is a small class and I will know when you are not present. Do not put me in a position to have to take disciplinary action. **This applies for lecture, lab, and exams!**

COURSE OUTLINE

STREAMS: THE PHYSICAL ENVIRONMENT

I. *Channels and Flow* – Introduction to hydrology and the characteristics of river channels

II. *Streamwater* Chemistry – Dissolved components in water and their influence

III. *Physical Factors of Importance to Biota* – The influence of current, substrate, temperature, and oxygen

ENERGY SOURCES AND FLOW

IV. *Autotrophs* – Periphyton, phytoplankton, and macrophytes, oh my!

V. *Heterotrophic Energy Sources* – Organic matter, it's not just for breakfast anymore!

VI. *Trophic Relationships* – Feeding ecology and food webs

TROPHIC INTERACTIONS IN STREAMS

VII. *Predation and its Consequences* – Optimal foraging and predatory control

VIII. *Herbivory* – Grazers and their influence on streams ecosystems

IX. *Competitive Interactions* – Distribution and resource partitioning

LOCAL AND REGIONAL PATTERNS IN STREAMS

X. *Drift* – Movement of stream dwellers and its consequences

XI. *Lotic Communities* – Community structure and geographic diversity

XII. *Organic Matter in Lotic Systems* – Longitudinal gradients in streams

XIII. *Nutrient Dynamics* – Transport, transformation, and cycling of nutrients

XIV. *Modification of Running Waters by Humankind* – History of river modification

GRADING

Students are expected to adhere rigidly to the due dates for each assignment. Late assignments will lose 10% of the total possible score for each day they are late. Grades will be determined as defined below.

Exam I	150
Exam II	150
Final Exam	200
Laboratory Assignments	150
Class Project	350
Grade	1000 pts

A = 900-1000
B = 800-890
C = 700-790
D = 600-690
F < 600

INSTRUCTOR ABSENCES

There will be times during the semester when the instructor will be at professional conferences, conducting research, or will be otherwise unable to attend class. **Class will not be cancelled for any reason.** In the event that I cannot attend class, you will have a guest lecturer, in-class assignment or exam, or class will be moved to another time for that session.

EXTRA HELP

I am always available for extra help by appointment or at any time that I am in my office. However, it is best to e-mail me and make an appointment if you need to see me outside of my office hours.

CHEATING

Cheating will not be tolerated and will be punished with a “0” on the assignment, project, or exam in question.

STUDENTS WITH DISABILITIES

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University’s commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the Department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Michael Washington, Office of Disability Services located in Caldwell Hall, Room 202, telephone (870) 575-8293.

INSTRUCTIONAL RESOURCES

Materials in addition to the required text will be provided to the student in advance to the class for which the material will be discussed.

LAB SCHEDULE

The lab schedule is not firm due to the nature of this course. Lab scheduling will depend on selected individual and class projects, weather, equipment availability, and so forth. However, some of the general lab topics we will cover during the semester described below:

Catchment Basins and Stream Order: Understanding watersheds, landscape features, rainfall patterns, geology, and human land-use practices.

Stream Physical and Chemical Measurements: Measuring discharge and current velocities, stream water quality measurements, substrate analyses.

Trophic Ecology and Energy Sources: Analyses of autochthonous and allochthonous energy inputs, food webs, nutrient cycling.

Stream Invertebrates: Collection, identification, ecology, movement, and use in biomonitoring.

Vertebrate Stream Communities: Assessment, ecology, morphological adaptations, and use in measurement of biotic integrity.

Unifying Concepts in Stream Ecology: The River Continuum Concept, Serial Discontinuity, Flood-Pulse Concept, Nutrient Spiraling Concept.

Anthropogenic Influences: Human impacts on streams; deforestation and its influence on flow, hydrographs, sedimentation, and temperature; pollution; man-made structures.

Field studies will be an integral part of the class. There will be two weekend field trips during the first half of the semester. These will involve an overnight stay (camping). More information of camping trips and student supply needs will be given prior to each trip.

Lab assignments will be directly related to lab activities, and will usually be integral to class projects. Therefore, although lab assignments are only 15% of the final grade, hard work on lab assignments will reduce effort later in the semester as the class project due date approaches.

Univariate and Multivariate Models (GAQF 5406)

Session: Spring 2006
Time: MWF, 9 - 10:15 AM
Location: Woodard 257

Instructor: Dr. Lin Xie
Office: Woodard Hall, Rm 228
Phone: 870-575-8157
Email: lxie@uaex.edu
Office hours: Monday 2-5 PM, Wed. 2-4 PM

Prerequisite: GAQF 5405 (Statistics in Research)

Course Description
This course will cover the models that are designed to deal with univariate and multivariate data types. Univariate models are used to analyze the data having single response variable with single or multiple explanatory variables. Multivariate models are for the cases of multiple response variables. These models are useful for pattern recognition and species community analysis. The statistical modeling techniques taught in this class include multiple regressions, model selection methods, multivariate ANOVA, ordinations, and classification analyses. Theories and applications to real-world examples will be used to understand the statistical methods.

Course Objectives
- Introduce students the concept of univariate and multivariate data structure.
- To understand and implement common univariate and multivariate models.
- To learn what appropriate method to choose for a given dataset and problem.
- To learn how to communicate their statistical findings with scientific community
- To learn how to interpret multivariate analyses in the scientific literature.
- At the end of class, students will be equipped with advanced statistical knowledge and techniques that are needed for their own research data analysis.

Instructional Strategy
Class will be a combination of lectures and computer demonstrations for problem solving and data analysis. The students will be encouraged to actively take part in the process of problem solving during the lectures. Students will be given weekly assignments with data from real world examples that require the knowledge and skill obtained during the class. It will consolidates their understanding of statistical methods and techniques for data analysis they learn from class.

Teaching Model
The class will follow the direct interactive teaching model. In this model, there will be a clear objective for each lessons and students will be challenged to be involved in formulating solutions. The students are encouraged to discuss on the homework assignments with other classmates. Assignments and the tests will be discussed and

reviewed in the class to ensure that students digest the knowledge of the topics covered in the class.

Instructional Resources
Required text:
(1) Statistical Sleuth: a course in methods of data analysis, 2nd edition, by F. Ramsey and D. Schafer, Duxbury
(2) Analysis of Ecological Communities, By Bruce McCune and James B. Green, MJM Software Design

Computer software: SAS and PC-ORD

The book, "Statistical Sleuth" will be used as the text book for univariate models, and "Analysis of Ecological Communities" for multivariate models in this class. To solve the problems and analyze the data, SAS and PC-ORD will be used as computing tools.

Bibliography
Applied Regression Analysis, 3rd edition, by Norman R. Draper and Harry Smith, Wiley.

Multivariate Analysis in Community Ecology, by Hugh G. Gauch Jr., Cambridge University Press.

Data analysis in community and landscape ecology by Jongman, R. H. et al. Pudoc Wageningen.

Numerical Ecology, 2nd edition, by Legendre, P. and Legendre, L. 1998. Elsevier, Amsterdam.

Using multivariate statistics. 3rd edition. by Tabachnick, B. G. and Fidell, L. S., Harper.

The Little SAS Book: A Primer, 3rd edition, by Lora D. Delwiche, Susan J. Slaughter, SAS Institute Inc.

Assignments
There will be biweekly assignments (20 points each). The assignments will be comprised of the exercise questions from the text book, and the actual data analysis with real-world examples. Problem solving questions require the detail steps of derivations and procedures to the solution for full points. Data analysis requires the summary of statistical findings and statistical inferences from the analysis as well as test statistics. Although students are encouraged to discuss the assignments, the identical write-ups of solutions will be considered as cheating and no score will be given. Overdue turn-in will automatically reduce 20% from full points for each additional delayed day.

Exams and Grading Policy
There will be 2 midterm exams and one comprehensive final.

Mid-term Exam1	100
Mid-term Exam2	100
Final Exam	150
HW Assignments	120
Total	470

Grading scale for this class out of full points (470) is:

A: 90-100% (470-418.3), B: 80-89% (418.2-371.3), C: 70-79% (371.2-324.3),
D: 60-69% (324.2-277.3), F: 0-59% (277.2-0)

Notes: The exams will be comprised of short answers, and problem solving questions. The exams will be given during regular class hours in the same classroom. All the exams are closed books, however student are allowed to bring a half letter-size sheet for formulas to use during the exams. Hand-held calculator is allowed to use during exams. No make-up exam will be given, except emergency situations, such as hospitalization for illness.

Cheating
No Cheating will be tolerated for the assignments and the exams. Cheating includes copying other students' homework assignment and looking at someone else's answers during exams. Cheating will result in zero score earning in the portion of an assignment or an exam.

Attendance Policy
It is mandatory for students to attend all classes. If any student must miss a class for the reasons of conference attendance, sampling trips, and others, a student must notify the instructor beforehand. The instructor is not responsible to provide class material for missing classes. It is the student's responsibility to make up the missing classes by obtaining the materials from other classmates and self-study.

Cell Phone Policy
Cell phone or any personal communication device should be turned off before entering the classroom. Any student uses such a device during class will be asked to leave class immediately and not to return.

Disability Policy
It is the UAPB policy to accommodate students with disabilities, pursuant to federal law and state law. Any Student who needs accommodations, such as special arrangements for seating and transportation, are encouraged to inform the instructor or contact with Mr. Michael Washington in Caldwell Hall, Room 205, Phone (870) 575-8293, Email: Washington-m@uapb.edu

Course Schedule

Week	Dates	Sections	Material
1		---	Introduction
2		S*: Chap.9	Multiple Regression
3		S: Chap.10	Inferential Tools
4		S: Chap.11	Model Checking & Refinement
5		S: Chap.12	Variable Selection
6		S: Chap.20	Logistic Regression for Binary Data
7		S: Chap.21	Logistic Regression for Binomial
8		S: Chap.22	Logistic Regression for Poisson
9		A**: Part.1	Multivariate Data & Transformation
10		A: Chap.14	Principal Components Analysis
11		A: Chap.16	Nonmetric Multidimensional Scaling
12		A: Chap.19	Correspondence Analysis
13		A: Chap.24	MANOVA & MRPP

14	A: Chap.26	Discriminant Analysis
15	A: Chap.11	Hierarchical Clustering
16	---	Final Week

* S: Statistical Sleuth
** A: Analysis of Ecological Communities

Aquatic Chemistry and Analysis

Number: GAQF 5440

Instructor: Dr. Yushun Chen

Schedule: This class is held during the fall semester of even-numbered years

Class Times: Lecture: MWF

Prerequisite: None

Course Description: The physical, chemical, biological, and hydrological characteristics of surface water systems will be reviewed. Specific attention will be given to procedures that evaluate interactions among water, soils, and biota that provide the driving forces behind overall productivity of aquatic systems and carrying capacities of pond aquaculture facilities. This course is useful to all aquaculture and fisheries scientists.

Required Text: Boyd, C.E. and C.S. Tucker. 1998. Pond Aquaculture Water Quality Management. Springer Publishing.

Topical supplementary readings will be assigned from other sources.

Objectives: This course will provide students with an understanding of (a) the fundamental chemical principles affecting water quality in aquatic environments, (b) the biological, chemical and physical processed that affect water quality, (c) skills required to evaluate water quality problems with basic analytical and laboratory skills.

Teaching Model: Basic information will be presented in the reading materials. Class time will be spent reviewing and discussing the material, working on solving problems related to the reading materials, presentations of practical examples of the concepts in the readings, and discussion of current research regarding water quality for aquaculture, based on the concepts presented in the reading materials.

Instructional Strategies: Students will have the information presented in the reading material reinforced in the classroom through discussion of applications and solving current, real-world problems.

Seminars: Lab sessions at the end of the semester will be devoted to student presentations. Each student will choose a paper concerning water quality published in the past 5 years from a refereed scholarly journal. Present the material from the paper, respond to questions, and initiate conversation on the topic.

Other assignments: As learning tools, 3 analytical problem sets will be provided. Students are encouraged to complete all work on these problems independently. The instructor will supply written explanations, including calculations. These assignments may be reviewed and discussed in class, but will not be collected or graded.

Bibliography:

APHA. 2006. Standard methods for the examination of water and wastewater, 21st edition. American Public Health Association, Washington, DC.

Benjamin, M.M. 2001. Water chemistry. McGraw-Hill, New York. 668 pp.

Boyd, C.E., C.W. Wood and T. Thanjai. 2004. Aquaculture pond bottom soil quality management. A/CRSP, Oregon State University. 41 pages.

Boyd, C.E. and C.S. Tucker. 1992. Water quality and pond soil analyses for aquaculture. Alabama Agricultural Experiment Station, Auburn.

Hem, J. 1986. Study and interpretations of the chemical characteristics of natural water. U.S. Geological Survey, Water Supply Paper 2254. (available as pdf from web).

Likens, G.E. and F. H. Bormann. 1995. Biogeochemistry of a forested ecosystems, 2nd Edition. Springer-Verlag, New York, 159 pp.

Millero, F.J. 2000. The physical chemistry of natural waters. John Wiley & Sons. 680 pp.

Stumm, W. and J.J. Morgan. 1996. Aquatic chemistry. 3rd Edition. John Wiley & Suns. 1022 pp.

Fact sheets by Southern Regional Aquaculture Center, by various authors:

Measuring Dissolved Oxygen Concentration in Aquaculture
Carbon Dioxide in Fish Ponds
Interactions of pH, Carbon Dioxide, Alkalinity and Hardness in Fish Ponds
Ammonia in Fish Ponds
Algae Blooms in Commercial Fish Production Ponds
Pond Mixing
Water Quantity and Quality Requirements for Channel Catfish Hatcheries
Toxicities of Agricultural Pesticides to Selected Aquatic Organisms

Evaluation procedures: Two unit examinations delivered during the semester and a final examination at the end of the semester will be administered (350 pts). Laboratory reports will be scored and contribute up to 50 points for the semester. Presentation of topic during seminar will account for up to 100 pts.

Grading:

First 1-hour exam	75 pts	Subject matter on exams will be *cumulative*.
Second 1-hour exam	125 pts	Student's numerical scores will be averaged.
Seminar	100 pts	Final grades will be assigned according to
Lab	50 pts	the rubric shown below
Final Exam	150 pts	

A	90-100%	(450-500 pts)
B	80-89%	(400-449 pts)
C	70-79%	(350-399 pts)
D	60-69%	(300-349 pts)
F	< 60%	(< 300 pts)

Course Outline:

Week	1	Overview, aquatic systems, hydrologic cycles
	2	Analytical methods, sampling, quality control
	3	Temperature, light
	4	Alkalinity and pH
	5	Dissolved gasses (oxygen, carbon dioxide)
	6	Nutrients (nitrogen, phosphorus)
	7	Hardness, salinity, chloride
	8	Metals (iron, mercury, copper, zinc)
	9	Turbidity and settleable solids
	10	Bottom soils
	11	Phytoplankton, periphyton, filamentous algae
	12	Other biota (aquatic plants, zooplankton, bacteria)
	13	Toxins and contaminants

Laboratories: There will be one laboratory designed for students to learn analytical methods for each of the topics in the course outline.

Students with disabilities: It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encourage to contact Mr. Ray Watley, Office of Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

Class Attendance Policy: ATTENDANCE OF LECTURES IS REQUIRED. BE ON TIME. PUNCTUALITY IS A MEASURE OF RESPECT FOR YOUR CLASSMATES

AND INSTRUCTOR. The University requires regular class attendance of all students. While attendance and tardiness are primarily student-teacher relationships, the University has a concern in the proper fulfilment of such obligations by the student.

1. At the beginning of each class period, the instructor will take roll and note attendance or non-attendance in the roll book.

6. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

7. An absence is excused when a student is absent from class due to participation in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or when a student is confronted with an extenuating circumstance, such as death in the immediate family, a judicial case, or serious illness., etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.

8. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

9. If a student continues to accumulate unexcused absences in excess of the number described in item 2 then the student will be penalized by having 25 points (one half letter grade) removed from their final semester score for each additional unexcused absence.

Laboratory Rules:

1. No food or drinks are allowed in the laboratory during labs.
2. Keep your work area clean.
3. Discard used materials as follows:
    Animal parts: into receptacle specifically marked for this purpose.
    Broken glass/sharp objects: into receptacle specifically marked for this purpose.
    Chemical waste: ask the instructor for specific instructions.
    General waste: papers, paper towels, etc. can be discarded into the regular trash bins.
4. Report all injuries to the instructor immediately.
5. Become familiar with the location of first aid kits, fire extinguishers, and eyewash stations.
6. Wash your hands well with warm water and soap before leaving the laboratory.
7. Make sure your work area is clean before you leave lab. The tabletop should be wiped down with a damp sponge, all refuse should be properly disposed of, and chairs or stools should be placed under the lab bench.
8. Whenever live specimens are used, we will conform to the Aquaculture/Fisheries Center Animal Welfare Guidelines. These Guidelines are posted in the lab.

Cell phones and pagers: Turn off your cell phones before class. Noisy disruptions are unacceptable as is leaving the classroom to take a call

FISHERIES GRADUATE SEMINAR
(GAQF 5195)

Fall Semester, 2008
Tuesday 11:00-12:15

Instuctor: Dr. Rebecca Lochmann

Office address: 106 S.J. Parker Agricultural Experiment Station
Phone: 575-8124
Fax: 575-4639
E-mail: rlochmann@uaex.edu

Office hours: Wednesday 1- 4 p.m. or by appointment

Prerequisites: BS degree.

Course Content: Students will find, present, and discuss examples of material (newspaper articles, journal articles, video clips, & other forms of media) that relate to aquaculture and fisheries. The factual nature and objectivity of the material will be critiqued, as well as the potential or actual impacts – positive and negative – that the media has on the fields of aquaculture and fisheries.

Course Objectives:

1. Provide a forum for students to prepare, present and discuss material relating to a central theme. This year's theme is: Media Portrayal of Aquaculture & Fisheries – the Good, the Bad, and the Ugly**.**

2. To increase the student's exposure to a variety of viewpoints and to strengthen group interactive skills and leadership skills through group exercises and discussions.

Objectives will be considered achieved when all graded exercises based on the objectives result in an average score of 80% or higher.

Instructional Strategies:

1) Student presentations with instructor and peer feedback
2) In-class exercises (case studies, discussions, debates, role-playing)
3) Attendance at meetings
4) Invited speakers &/or field trips

Teaching Models: A combination of individual and group exercises, written and oral, will be used to introduce and reinforce class material.

Instructional Resources:

1. Reclaiming the Media: Communication Rights and Democratic Media Roles (Intellect Books - European Communication Research and Education Association). Bart Cammaerts and Nico Carpentier, editors.

2. Murky Waters: Environmental effects of aquaculture in the United States. Environmental defense fund, Rebecca Goldberg and Tracy Triplett. 1997.

3. The content of favorable and unfavorable polyunsaturated fatty acids found in commonly
eaten fish K. L. Weaver, P. Ivester, J. A. Chilton, M. D. Wilson, P. Pandey, and F.H. Chilton. Journal of the American Dietetic Association 108:1178-1185.

4. Sea Grant: http://www.seagrant.noaa.gov/roe/roe.html

5. Environmental protection agency: www.epa.gov/

6. United States Fish and Wildlife Service: http://www.fws.gov/fishing/

7. United States Department of Aquaculture: www.ers.usda.gov/Briefing/Aquaculture/

Bibliography:
Pew Charitable Trusts: media relations.
http://www.pewtrusts.org/news_room_contacts.aspx

Course Outline/Assignments:
Specific assignments will be determined in consultation with the class during the first week of class, as the nature and scope of assignments depends on class size, specific interests of the students, and relevant current events related to media coverage that arise during the semester. A master schedule will be updated regularly and distributed to all students by e-mail.
Examples will include:

Case studies

Debates over recent or historically significant media coverage of Aquaculture and Fisheries (some topics assigned; some chosen by the students)

Presentations over aspects of media coverage in aquaculture and fisheries – how we influence them; how they influence us.

Grades will be based on:

1. Participation (150 points): This is the most important category. It includes class attendance, presentations, evidence of preparation and quality of participation in debates, interaction with invited speakers and student presenters (ask questions!), and performance on in-class written and oral assignments.

Note: Each student taking this course for credit is expected to give a presentation and/or lead a discussion or debate on an assigned topic. All students are expected to participate in the discussions and critique debates they observe.

2. Attendance at meetings (50 pts): If you attend a scientific meeting this semester, prepare a written summary of 3 or more of the talks you attended to hand in for credit. If you presented a paper, submit your abstract in place of one of the summarized talks. If you attend a type of professional meeting that does not have formal scientific talks, describe the meeting's agenda and summarize the important issues discussed at the meeting. The "village meetings" at Lake Chicot to discuss crappie or bird depredation issues qualify in the latter category. Everyone should be able to attend at least one meeting this semester. See me if you are not aware of any meetings you can attend this semester.

3. Student notebook (50 pts): This consists of an organized (by date) set of notes and assignments representing the activity pursued in each class. Include all handouts, assignments and notes taken during oral presentations by others. Students should have an entry for every class period.

Total points possible for the class: 250 (with no more than 1 unexcused absence); 300 (with more than 1 unexcused absence)

CLASS ATTENDANCE POLICY

The University requires regular class attendance of all students. While attendance and tardiness are primarily a student-teacher relationship, the University has a concern in the proper fulfillment of such obligations by the student.

9. At the beginning of each class period, the instructor will take the roll and note attendance or non-attendance in the roll book. Each course syllabus will carry a stipulation regarding tardiness and absences.

10. When a student accumulates as many unexcused absences as the number of credit hours represented by the course, the teacher will notify the student and document the notification.

11. An absence is excused when a student is absent from class due to participating in programs, activities, etc. that are sponsored by the University and verified by the sponsor, or such as death in the immediate family, a judicial case, or serious illness, etc. These absences will be excused only when the student presents official documentation of the situation to the teacher. All other absences are unexcused.

12. When a student misses classes in excess of the number outlined in item 2 above, whether due to negligence or some other reason, the instructor will warn the student that additional absences may result in failure to pass the course.

SEMINARS DO NOT WORK if people do not attend and participate. Roll will be taken every class period. The maximum allowable number of unexcused absences for this class is 1 (one). **Any student that has more than 1 unexcused absence will be required to take a comprehensive final written exam addressing the content of the course (50 points).** Attendance is vital as many of these activities cannot be made up. **You are responsible for all material covered in every class.** This class will meet in 257 Woodard Hall unless otherwise announced. Any schedule changes not announced in class will be posted on my office door in advance (and e-mailed to you).

STUDENTS WITH DISABILITIES

It is the policy of UAPB to accommodate students with disabilities, pursuant to federal law, state law, and the University's commitment to equal educational opportunities. Any student with a disability who needs accommodation, for example in seating placement or in arrangements for examinations, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are also encouraged to contact Mr. Ray Watley, Office of Veterans Affairs and Disability Services located in Caldwell Hall, Suite 205, telephone (870) 575-8293.

Cell phones: Turn off your cell phones in class or leave them at home. Noisy electronic devices are disruptive, as is leaving the classroom to take a phone call.

Appendix D
History of Collaboration and Partnering of Aquaculture/Fisheries Center with Other Universities, Agencies, and Institutions

The Aquaculture/Fisheries Center is engaged with a number of different institutions in a variety of research and extension activities. Some of these occur through formal contracts and subcontracts between UAPB and other institutions. Other interactions occur through long-standing participation on the part of the Aquaculture/Fisheries Center in consortia and regional programs. Still others result from collaborative research and extension initiatives that originate between individual research and extension faculty with their colleagues in other institutions or from interactions of Aquaculture/Fisheries Center faculty in professional associations. This section will describe the long-standing participation in consortia and regional programs and then list other project-specific types of multi-institutional research and extension activities.

The UAPB Aquaculture/Fisheries Center has participated in the USDA Southern Regional Aquaculture Center (SRAC) for over 22 years. All SRAC projects are required to be multi-state and multi-institutional. Aquaculture/Fisheries Center scientists have served on the Technical Committee of SRAC for over 20 years. Five different scientists have served on the Technical Committee, and UAPB Aquaculture/Fisheries scientists have chaired or are chairing four different SRAC regional projects. Seven scientists have participated in different SRAC projects. Currently (2011), UAPB is a participant on six approved regional SRAC projects (chairing four of the steering committees) and is the lead institution on four of the projects. Over the past 5 years, UAPB scientists have collaborated with research and extension faculty at 15 different institutions on SRAC projects, and have participated in 83% of the SRAC projects approved over the past 5 years, playing a significant role in 50% of these.

The UAPB Aquaculture/Fisheries Center also has had a long-standing (>18 year) relationship with what is now called the H.K. Dupree Stuttgart National Aquaculture Research Center, now with USDA-ARS (formerly the U.S. Fish and Wildlife Service). The collaborations have taken various forms over the years, but in the last 5 years, there have been 15 refereed journal articles published with joint authorship of UAPB and Stuttgart scientists. Four scientists at the ARS-Stuttgart laboratory hold adjunct faculty status with the UAPB Aquaculture/Fisheries Center and serve on graduate thesis committees. Currently, there are three UAPB graduates working as full-time technicians in the Stuttgart laboratory.

The UAPB Aquaculture/Fisheries Center is a founding member of the Aquaculture Collaborative Research Support Program (ACRSP), funded by the U.S. Agency for International Development. ACRSP is a consortium of 29 universities that work on a variety of international projects related to aquaculture development. Over the past 5 years, UAPB Aquaculture/Fisheries Center scientists have participated in projects in five different countries, co-authoring 7 refereed journal articles, and being the lead institution for the Africa project.

Several UAPB Aquaculture/Fisheries Center scientists participated on a large, multi-institutional and multi-state project to identify the feasibility of establishing crop insurance programs for aquaculture. Mississippi State University is the lead institution on the project, but six UAPB Aquaculture/Fisheries Center faculty and staff participated in the catfish and baitfish portions of this project. The overall project is funded by the Risk Management Agency.

The Arkansas State Plant Board is a regulatory agency with authority over the use of pesticides and other chemical compounds in the state. The lead fish health scientist of the UAPB Aquaculture/Fisheries Center works closely with the State Plant Board to develop requests for Section 24-C Special Local Needs and Emergency Section 18 Exemptions for diuron for catfish farming and for other compounds that can be used for non-foodfish species such as the baitfish species. He also conducts annual training session for Plant Board investigators.

The Arkansas Development and Finance Authority (ADFA) houses the Arkansas State Aquaculture Coordinator, the Governor's liaison with the aquaculture industry. The UAPB Aquaculture/Fisheries Center works closely with the State Aquaculture Coordinator and provides science-based information on policy and industry issues to the Coordinator. The ADFA Coordinator has an office in the Aquaculture/Fisheries suite in Woodard Hall.

The Arkansas Game and Fish Commission (AGFC) is charged with managing the state's wildlife, fisheries and aquatic resources. Given its mandate to manage the fisheries resources of the state, the AGFC was selected as the primary stakeholder for the natural fisheries portion of the UAPB Aquaculture/Fisheries Center. Cooperative work with AGFC occurs on a number of levels, including formal agreements and AGFC-funded projects on community fishing programs, the crappie fishery in Lake Chicot, and fish communities on the Ouachita River, Felsenthall Wildlife Management Area. In 2005, the Director of the UAPB Aquaculture/Fisheries Center was asked to chair a committee to design a state-wide consortium of universities to provide integrated and comprehensive research support to AGFC. Workshops have been organized at AGFC's request.

In addition to these long-standing, formal multi-institutional projects, UAPB Aquaculture/Fisheries Center scientists collaborate with a wide variety of other scientists on specific grants and projects. Over the past 5 years, these grant-specific collaborative projects have included the following institutions:

Animal Plant and Health Inspection Service

Arkansas Bait and Ornamental Fish Growers Association

Arkansas Game and Fish Commission

Arkansas Tech University

Auburn University

Clear Springs

Clemson University

Dauphin Island Sea Lab

Delaware State University

Department of Agriculture, North Carolina

Department of Natural Resources, Puerto Rico

Escuela Agrícola Panamericana de Zamorano

George Washington University

Grand Bay Nacional Estuarine Research Reserve

Instituto Internacional Amazónica del Perú

H.K. Dupree Stuttgart National Aquaculture Research Center

Kansas State University

Kentucky State University

Louisiana State University

Memphis State University

Mississippi State University

Moi University

National Aquaculture Association

National Center for Toxicological Research, Food and Drug Administration

National Oceanographic and Atmospheric Administration

North Carolina State University

Purdue University

Rutgers, The State University of New Jersey

Southern Illinois University

Texas A&M University

Texas Parks and Wildlife

Texas Tech University

The Ohio State University

Universidad Centroamericana, Nicaragua

Universidad Juarez Autónoma de Tabasco, Mexico

University of Arkansas at Little Rock

University of Arkansas at Monticello

University of Arkansas Medical Sciences

University of Edmonton, Canada

University of Florida

University of Idaho

University of Oklahoma

University of Puerto Rico

University of Southern Mississippi

U.S. Fish and Wildlife Service

Virginia State University

Washington State University

Appendix F
Publications List, Aquaculture/Fisheries Center, 1976-2010

Aquaculture/Fisheries Center
Publications Listing

I. RESEARCH PUBLICATIONS

Books

Engle, C.R. 2010. Aquaculture Economics and Financing: Management and Analysis. Wiley-Blackwell Publishing Company.

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APPENDIX G
Overview of Research and Extension Programs

The U.S. baitfish industry is a $37.5 million/year industry (farm gate value), having an economic impact in Arkansas of more than $183 million, and producing 80% of the country's farm-raised baitfish. However, the vast majority of baitfish farmers (97%) are small farming businesses. Given the small size of these businesses and their limited geographic distribution, few universities have focused on this unique segment of aquaculture and many of the technologies recently in common use were developed over 50 years ago. New technologies were needed to reduce costs to maintain economic viability to enable U.S. baitfish farms to compete with wild-caught bait and artificial fishing lures. Experiments were developed to 1) evaluate egg incubation conditions for important baitfish species; 2) compare compounds for de-sticking eggs for incubation; 3) determine optimal stocking rates in ponds; 4) compare diet ingredients and levels, and 5) provide the data and regulatory support needed for the Arkansas labeling of critical aquaculture chemicals. A baitfish verification program was developed to demonstrate the validity of research-based recommendations on cooperating farms. These new technologies are now widely used by the industry to produce baitfish fry in less than half the time and in reliable quantities. The technology has been transferred throughout the industry as the new standard practice. Recommended fry stocking rates have been verified on farms through the verification program and increasing numbers of farms are adopting the recommmended pond production practices. Improved diets have been developed, particularly for baitfish broodstock that enhance egg quality and production. This research initiative has been extended to fathad minnows (both normal and rosy red). Results from two years of studies demonstrated that yields of 2,500 to 4,500 lb/acre can be obtained in experimental ponds. Estimated profits were substantially higher with indoor hatching technology. Six chemicals critical in baitfish production are legally available directly due to Center efforts. The combination of research and extension activities has helped this aquaculture industry to remain competitive and viable.

Exotic viral diseases of cyprinid fish are a continuing threat to the bait and ornamental fish industries (ornamental fish have an additional farm gate value of $69 million). Molecular biology techniques (PCR) were used to develop rapid diagnostics procedures for Spring Viremia of Carp, and other important viruses. UAPB has become renowned across the U.S. and the world for its work identifying SVCV in the U.S. and its subsequent role in the disinfection and surveillance programs nationwide. The UAPB lab was BSL-2 licensed (by APHIS, 2004) and provides diagnostic reference materials to U.S. laboratories, including the APHIS reference laboratory. UAPB conducted the national SVCV surveillance study for APHIS, developed the original shipping facility disinfection plan, and provided leadership for the $11,000,000 farm disinfection plan. The four UAPB diagnostic laboratories diagnose more than 2,000 cases annually and are a very visible example of UAPB's commitment to solving the problems of rural areas in Arkansas. Cases handled by the labs are primarily from aquaculture, but many cases also involve private fishing ponds or assistance to Arkansas Game and Fish. While most cases are from Arkansas, the UAPB labs remain on the cutting edge of new disease discovery by handling cases from more than 25 states per year. The surveillance, inspection, and education programs have convincingly documented that dangerous viruses are not present in Arkansas aquaculture, allowing Arkansas farmers continued market access. The following biosecurity extension programs have been developed: 1) HACCP biosecurity on fish farms; 2) Quality Bait program approved by the state legislature; 3) biannual fish health inspections; and 4) on-farm disinfection programs and equipment. More than 95% of all Arkansas bait and ornamental fish production acreage is in the Certification Program. Farm biosecurity plans have prevented the introduction of any exotic diseases of current US regulatory concern (VHS, SVCV, KHV). If work done by our diagnostic program saves only 10% of the fish in ponds associated with cases submitted to our laboratories (a very conservative estimate), savings to Arkansas farmers mount to more than $7,000,000/yr. More than $1,000,000/yr in fish every year are exported to other states and countries based on health inspections available only at UAPB. Biosecurity measures taken in Arkansas in 2010 have apparently greatly restricted the introduction and spread of the new strain of aeromonas in Arkansas. Losses from this disease in Alabama in 2009 and 2010 were several million dollars. In Arkansas only a few thousand dollars worth of fish have been lost.

The U.S. catfish industry has struggled through several years of low prices and severe cash flow probelems. The center responded by developing programs to reduce production costs and to assist the industry to identify areas where marketing of the US product could be improved. Econometric analyses by Center faculty identified economic factors contributing to the low prices. Pond, tank, and aquaria studies identified optimal stocking/feeding strategies for both low and average price cycles. Catfish growth and feed allocation models were developed to facilitate cash flow budget analysis on farms. Training progams transferred new spreadsheet models to farmers. A survey of catfish producers in Chicot County, Arkansas provided data to develop an IMPLAN-based impact analysis. Imports of basa from Vietnam and the national economy were shown to contribute significantly to low prices. Reducing stocking/feeding rates and strategically feeding those ponds that contribute the most to cash flow generated greater profits than restricting feed across the entire farm. Financial planning methods have been adopted by farms, improving farm financial management and decision making. An in-pond fish grader has enabled catfish farmers to stock more uniform sizes of fingerlings and to return 2-4 times more sub-harvestable catfish to ponds for additional growth. The technology underlying the grader constituted the first patent held by UAPB. The grader has been adopted widely throughout the catfish industry with net benefits per farm that range from $9,000 to $160,000. Production expenses are also reduced through the Center's annual efforts to obtain Arkansas labeling for compounds used to control off flavor. The catfish industry in Chicot County generated $384 million in total economic output, 2,665 jobs to the local county economy, and $22 million in tax revenue.

New formulations of catfish feed showed that some of the less expensive diets resulted in yields of larger carryover fish that were similar to those of more expensive diets. However, understocked fingerlings did not grow as well. These results do, however, provide some management options for catfish farmers for less expensive feed options. Marketing research has been intensified to seek out new markets with potential to enhance farm profitability. Surveys showed that the live fish markets in Asian ethnic markets are growing rapidly and studies have identified the most important product attributes. Econometric models of the U.S. catfish industry have provided guidance to the industry of strategies and policies to improve competitiveness of the U.S. industry. Arkansas Game and Fish Commission (AGFC) became concerned about bass fishing on the Arkansas River during the early 2000s. Concerns focused on perceived declines in the fishery (mostly a reduction in size) being reported by some anglers, and a large increase in the effort required to catch a 5-lb bass being reported by bass tournaments. Although the angler perception may have changed for a time thereafter, perceptions had changed again by 2008 in that fishery had declined in quality and contained few large fish of harvestable size. For the most part, AGFC had little data on largemouth bass from the Arkansas River outside of Lake Dardanelle (Pool 10). UAPB addressed the issue by characterizing two importatnt components of the fishery for which little information existed – the biological aspects of the largemouth bass population and its population of anglers. As a result of serveral years of work, the AGFC now has a comprehensive database from which to model the bass fishery in the Arkansas River and make informed management decisions. Nuisance aquatic vegetation was a problem in Felsenthal Reservoir. Vegetation limited the areas in the Reservoir available for use by hunters, anglers, and recreational boaters. Visits to Felsenthal National Wildlife Refuge declined from 400,000 visits in 2004 to 200,000 visits in 2007. The overabundance of nuisance vegetation also caused declines in fishing quality in the Reservoir. This has had a tremendous impact on the local economy, as well as the quality of life in south Arkansas, as Felsenthal Reservoir is one of the most significant natural resources in the area. UAPB researchers demonstrated the feasibility of biological control with grass carp, despite the open nature of the Reservoir. UAPB researchers showed that the sport fish populations have increased in abundance and improved in size and structure. Anglers are reporting better fishing, and visits to the Refuge have increased 65% since the instigation of the control scheme.

Appendix H
Faculty Members' Experience in Supervising and Mentoring Graduate Students

Faculty member	Graduate Student	Status	
Madan Dey			
	Md. CoulamFarvque	graduated	Ph. D. program University of Stirling, UK
	Mahfuzul Haque	current	In Ph.D. program Wageningen University
	Istique Ahmed	current	In Ph.D. program Malaysian National University
	Ganesh Thapa	graduated	In Ph.D. program at University of Rhode Island
	Abed Rabbani	current	
	Prasanna Surathkal	current	
Carole Engle	Diego Valderrama	graduated	Assistant Professor, University of Florida
	Steeve Pomerleau	graduated	Catfish Farm Manager
	Ivano Neira	graduated	Consultant
	Jeremy Trimpey	graduated	Fisheries Biologist Hagerman National Fish Hatchery
	Brent Southworth	graduated	Fisheries Researcher, private company
	Carlos Leyva	graduated	Quality control specialist, private aquaculture firm
	Neil Pugliese	graduated	Hatchery Biologist, Texas Parks and Wildlife
	Ganesh Kumar	graduated	Research Associate
	Adam Nanninga	graduated	Research Associate
	Patty Eklund	graduated	
	Pratheesh Omana	graduated	In Ph.D. program, University of Rhode Island
	Pratikshya Sapkota	current	
	Umesh Bastola	current	
Nathan Stone	Troy Clemment	graduated	Hatchery Biologist, Wisconsin Dept. of Natural Resources
	Melinda Bodary	graduated	High school teacher
	Ignacio Masson	graduated	In Ph.D. program, U. of Southern Mississippi
	Marcella Melandri	graduated	Science Teacher
	Ashlee Paver	graduate	Maryland Department of Natural Resources
	Puspa Adhikari	current	
Andy Goodwin	Luke Iwanowicz	graduated	Research Biologist

			USGS-BRD Leetown Science Center Fish Health Branch West Virginia
	Kesavannair Praveen	graduated	Completed Ph.D., U. of Georgia
	Matt McIntyre	graduated	Fisheries biologist, USDA-ARS
	Swapna Thomas	graduated	
	Kelly Winningham	current	Fish pathologist, Arkansas Game and Fish Commission
	Nick Phelps	graduated	Fish Pathologist, University of Minnesota
	Scott Jones	current	
	Jennifer Jacobs	current	
Alf Haukenes	Mini Jose	graduated	
	Nicholas Barkowski	current	
Anita Kelly	Chris Green	graduated	Ph.D. Southern Illinois University/Asst. Professor, Aquaculture, LSU
	Anup K.C.	current	
Steve Lochmann	Emmanuel Frimpong	graduated	Ph.D.,Asst. Professor, Fisheries, Virginia Tech University
	Maurice Jackson	graduated	Aquatic Education Specialist, Alabama Game and Fish
	Amy Fenech	graduated	Biology Dept. Head, Colombus Technical College
	Elizabeth Heitman	graduated	Environmental Consultant, S&ME, Inc.
	Chris Racey	graduated	Asst Chief of Fisheries, Arkansas Game and Fish Commission
	Mike Carlson	graduated	Fisheries Biologist, U.S. Fish and Wildlife Serivce
	Chris Green	graduated	Assistant Professor, LSU
	Annette Fields	graduated	Teacher, Oak Park Elementary School
	Jeffrey Horne	graduated	Maryland Department of Natural Resources
	Lael Will	graduated	Research Associate
	Christy Adelsberger	graduated	Private Environmental Consulting Firm, New Mexico
	Brett Timmons	current	
	Brandon Baker	current	
	Kyle Rachels	current	

Rebecca Lochmann	Josh Reilly	graduated	Fish nutritionist at private aquaculture feed company
	Ruguang Chen	graduated	Research associate
	Biny Joseph	graduated	In Ph.D. program
	Bobban Gopinath	graduated	In Ph.D. program
	Sheeno Thyparambil	graduated	Ph.D.
	Sathya	graduated	Extension Associate
	Baby Sujia	graduated	In Ph.D. program
	Daryl Weldon	current	Department of Natural Resources, South Carolina
	Miles Thompson	current	Fisheries Consulting Firm, Wisconsin
	Jimmy Faukner	current	
	Michelle Thompson	current	
Peter Perschbacher	Todd Lenger	graduated	Research biologist, USDA-ARS
	Regina Edziye	graduated	In Ph.D. program
	Shawn Sanders	graduated	Fisheries biologist, U.S. Fish and Wildlife Service
	Mark Leao	graduated	Fisheries biologist, U.S. Fish and Wildlife Service
	Nathan Harris	graduated	
Mike Eggleton	Ben Lubinski	graduated	Fisheries biologist, Illinois Natural History Survey
	Ben Batten	graduated	AR Game and Fish Commission
	Brad Fontaine	graduated	Arkansas Game and Fish Commission
	Clint Peacock	current	
Yushun Chen	Daniel Grigas	current	
	Kat Herzag	current	
Previous faculty			
Wes Neal	Tom Lang	graduated	Assistant District Biologist, Kansas Game and Fish
	Paul Port	graduated	Assistant Trout Biologist, Arkansas Game and Fish Commission
John Jackson	Dan Dauwalter	graduated	Completed Ph.D., Oklahoma State University, employed with Trout Unlimited.
	Christopher Long	graduated	Fisheries Biologist, Virginia
Kwamena Quagrainie	Sanatan Shreay	graduated	In Ph.D. program, Washington State University
	Nathaniel Wiese	graduated	Assistant Project Leader Hagerman Fish Hatchery, U.S. Fish and Wildlife Service, Idaho

APPENDIX I
M.S. Student Publications, Abstracts, and Presentations, 2000-2010
(Bold indicates student name)

Refereed Journal Articles

2010

Clement, T. and N. Stone. 2009. Golden shiner egg production during a spawning season. North American Journal of Aquaculture 72:272-277.

Eggleton, M.A., J.R. Jackson and **B.J. Lubinski**. 2010. Comparison of gears for sampling littoral-zone fishes in floodplain lakes of the lower White River, Arkansas. North American Journal of Fisheries Management 30:928-939.

Eklund, P., P. Sapkota, C. Engle and G. Ludwig. 2010. Hybrid striped bass fingerling production costs in ponds and tanks. Aquaculture/Fisheries Field Day, UAPB, Pine Bluff, AR.

Engle, C. and **G. Kumar**. 2010. How cash flow and credit constraints affect stocking strategies on U.S. catfish farms. Aquaculture/Fisheries Field Day, UAPB, Pine Bluff, AR.

Engle, C., **G. Kumar** and D. Bouras. 2010. The economic trade-offs between stocking fingerlings and stockers: a mixed integer multi-stage programming approach. Aquaculture Economics and Management 14(4):315-331.

Horne, A.N., N. Stone and C.R. Engle. 2010. Development of new intensive hatchery methods for rosy red fathead minnow. North American Journal of Aquaculture 72:237-251.

Kumar, G. and C. Engle. 2010. Relative production performance and cost of food fish production from fingerlings of channel-blue F_1 hybrids, *Ictalurus punctatus*. Journal of the World Aquaculture Society 41 (4):545-554.

Ludwig, G., P. Perschbacher and **R. Edziyie**. 2010. The effect of the dye aquashade on water quality, phytoplankton, zooplankton, and sunshine bass, *Morone chrysops* X. *M. saxatilis*, fingerling production in fertilized culture ponds. Journal of the World Aquaculture Society 41(1):40-48.

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Port, P.R., J.W. Neal and S.E. Lochmann. 2010. Poststocking survival or hybrid striped bass after changes in water hardness and temperature. North American Journal of Aquaculture 72:118-123.

Pugliese, N.J. D. Heikes and C.R. Engle. 2010. Evaluation of a confinement system for growout of channel catfish. Journal of Applied Aquaculture 22(2):149-156.

Sapkota, P. and C. Engle. 2010. A comparative analysis of economic risk of hybrid striped bass fingerling production. Aquaculture/Fisheries Field Day, UAPB, Pine Bluff, AR.

2009

Engle, C.R., K. Ruebush**, C. Leyva and J. Trimpey**. 2009. The effect of dietary protein level on channel catfish *Ictalurus punctatus* production characteristics when feeding alternate days in multiple-batch production. North American Journal of Aquaculture 71(2):138-146.

Lochmann, R., **R. Chen**, F. Chu-Koo, W. Camargo, C. Kohler and K. Casper. 2009. Effects of carbohydrate-rich alternative feedstuffs on growth, survival, body composition, hematology, and non-specific immune response of black pacu, *Colossoma macropomum*, and red pacu, *Piaractus brachypomus*. Journal of the World Aquaculture Society 40(1):33-44.

Neira, I., C.R. Engle and C. Nguji. 2009. Economic and risk analysis of tilapia production in Kenya. Journal of Applied Aquaculture 21(2):73-95.

Pugliese, N.J., D. Heikes and C. Engle. 2009. Evaluation of a barrier confinement system for channel catfish, *Ictalurus punctatus*, production. Journal of the World Aquaculture Society 40(3):402-409.

Singh, K., M.M. Dey, **A.G. Rabbani, P.O. Sudhakaran and G. Thapa**. 2009. Technical efficiency of freshwater aquaculture and its determinants in Tripura, India. Agricultural Economics Research Review Vol. 22 pp. 185-195, July-December 2009.

Southworth, B.E., C.R. Engle and K. Ruebush. 2009. The effect of understocking density of channel catfish stockers in multiple-batch production. Journal of Applied Aquaculture 21:21-30.

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Colvin, N.E., **C.L. Racey** and S.E. Lochmann. 2008. Stocking contribution and growth of largemouth bass stocked at 50 and 100 mm into the Arkansas River. North American Journal of Fisheries Management 28:434-441.

Green, C.C. and A. M. Kelly. 2008. Effects of the estrogen mimic genistein as a dietary component on sex differentiation and ethoxyresorufin-O-deethylase (EROD) activity in channel catfish (*Ictalurus punctatus*). Fish Physiology and Biochemistry. Sept. 2008 (online).

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Kumar, G., K. Quagrainie and C. Engle. 2008. Factors that influence frequency of purchase of catfish by U.S. households in selected cities. Agricultural Economics Research Review 21:395-406.

Leyva, C.M. and C.R. Engle. 2008. Optimizing tilapia, *Oreochromis sp*., marketing strategies in Nicaragua: a mixed-integer transshipment model analysis. Journal of the World Aquaculture Society 39(3):339-351.

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Phelps, N.B.D. and A.E. Goodwin. 2008. Vertical transmission of *Ovipleistophora ovariae* (Microspora) within eggs of the golden shiner. Journal of Aquatic Animal Health 20:45-53.

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Lochmann, R. T. and **S. Kumaran**, 2006. Effect of practical diets with animal- or vegetable-protein sources and poultry oil or menhaden fish oil on adult fathead minnows *Pimephales promelas* in tanks. North American Journal of Aquaculture 68:281-286.

Masson, I., N. Stone and Y. W. Lee. 2006. Developing methods for harvesting rosy red fathead minnow eggs. North American Journal of Aquaculture, 68:296-305.

Southworth, B., N. Stone, and C. Engle. 2006. Production characteristics, water quality, and costs of producing channel catfish *Ictalurus punctatus* at different stocking densities in single-batch production. Journal of the World Aquaculture Society 37(1):21-31.

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Clemment, T. and N. Stone. 2004. Collection, removal and quantification of eggs produced by rosy red fathead minnows in outdoor pools. North American Journal of Aquaculture 66:75-80.

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Fenech, A.S., S.E. Lochmann, and A.A. Radomski. 2004. Seasonal diets of male and female double-crested cormorants from an oxbow lake in Arkansas. Waterbirds 27:170-176.

Frimpong, E.A., S.E. Lochmann, **M.Bodary,** and N.M. Stone. 2004. Suspended solids from baitfish pond effluents in drainage ditches. Journal of the World Aquaculture Society 35:159-166.

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Zhang, Z., A.E. Goodwin, T.J. Pfeiffer, H. Thomforde. 2003. Effects of temperature and size on ammonia excretion by fasted golden shiners. North American Journal of Aquaculture 66:15-19.

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Presentations

2010

Barkowski, N., B. Baker, B.A. Timmons, A. Haukenes and S.E. Lochmann. 2010. Standard metabolic rate of alligator gar *Atractosteus spatula* at three temperatures. International Network for Lepisosteid Fish Research and Management Meeting, Thibodaux, LA, May 26-28.

Bastola, U. 2010. Development of mathematical models for catfish production characteristics. UAPB Twenty-third annual student/faculty research forum. Pine Bluff, AR, March 10.

Chen, Y., **S. Pomerleau**, G. Selden and C. Engle. 2010. Does increased aeration increase catfish yields? Aquaculture/Fisheries Field Day, UAPB, Pine Bluff, AR. October 7.

Dey, M.M., **G. Thapa** and K. Singh. 2010. Live fish market in northeastern USA: past trend, current status, and future opportunities. Aquaculture 2010. San Diego, CA, March 5.

Dey, M.M., K. Singh and **P. Surathkal**. 2010. Gulf shrimp production in Arkansas? Aquaculture/Fisheries Field Day, UAPB, Pine Bluff, AR. October 7.

Eggleton, M.A., **B.G. Batten** and S.E. Lochmann. 2010. Largemouth bass fishery characteristics in the Arkansas River, Arkansas. Oral presentation. Southeastern Association of Fish and Wildlife Agencies Annual Conference. October 17-20, Biloxi, MS.

Ehmen, B., **D. Grigas**, T. Strange, W. Underwood, J. Lehrter, Y. Chen, J. Cebrian and M. Woodrey. 2010. Development of a habitat-health assessment tool for managers and decision-makers: a focus on watershed development and its impacts on estuarine communities. Poster Presentation. Alabama-Mississippi Bays and Bayous Symposium. Mobile, Alabama. December 1-2.

Eklund, P., P. Sapkota, C. Engle and G. Ludwig. 2010. Hybrid striped bass fingerling production costs in ponds and tanks. Aquaculture/Fisheries Field Day, UAPB, Pine Bluff, AR. October 7.

Engle, C. and **G. Kumar**. 2010. The effect of cash flow risk on stocking strategies on U.S. catfish farms: a mixed integer multi-stage programming approach. Aquaculture 2010, Annual Meeting of the World Aquaculture Society, San Diego, CA, March 2.

Engle, C.R., N. Stone and **A. Nanninga**. 2010. Foodfish production characteristics of largemouth bass *Micropterus salmoides* stocked at three densities. Aquaculture

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Faukner, J., H. Phillips, T. Sink and R. Lochmann. 2010. Effects of diets supplemented with standard soybean oil, soybean oil enriched with conjugated linoleic acids, marine fish oil, or an algal n-3 fatty acid concentrate on growth, health, feed conversion, survival, body composition, and shelf life of channel catfish. Aquaculture 2010, San Diego, CA, March 1-5.

Faukner, J. and R. Lochmann. 2010. Altering the lipid source in channel catfish (*Ictalurus punctatus*) diets. UAPB Twenty-third annual student/faculty research forum. Pine Bluff, AR, March 10.

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Fontaine, B.V. and M.A. Eggleton. 2010. Assessment of largemouth bass catch and exploitation in two Arkansas River pools: potential effects of competitive tournaments. Oral paper. Arkansas-Oklahoma AFS Chapter Annual Meeting, February 3-5, Fort Smith, AR.

Grigas, D., J. Cebrian, B. Ehmen, M. Woodrey, T. Strange, W. Underwood, J. Lehrter and Y. Chen. 2010. Loadings of total suspended solids (TSS) from stormwater runoff in a highly urbanized watershed, North Central Gulf of Mexico. Poster Presentation. The 2010 Arkansas Watershed Advisory Group Watershed Conference, Mountain View, AR. November 18-20.

Grigas, D., J. Cebrian, B. Ehmen, M. Woodrey, T. Strange, W. Underwood, J. Lehrter and Y. Chen. 2010. Loadings of total suspended solids (TSS) from stormwater runoff in a highly urbanized watershed, North Central Gulf of Mexico. Poster Presentation. The 2010 Southern Division AFS Student Colloquium, Mountain Home, AR. November 5-7.

Horne, J.R. and S.E. Lochmann. 2010. Mortality, growth, and condition of young-of-year wild largemouth bass following stocking of hatchery-reared advanced-fingerlings into backwaters of the Arkansas River. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Biloxi, MS, October 17-20.

Jose, M.T. and A.H. Haukenes. 2010. Estradiol and testosterone profiles of ovulating and non-ovulating channel catfish broodstock held under different temperature profiles. World Aquaculture Society Annual Meeting, San Diego, CA.

Kelly, A.M. and **S. Kumaran**. 2010. Disappearing golden shiner phenomenon- is hydrogen sulfide the culprit? Invited presentation. Aquaculture America, March 1-5, San Diego, CA.

Kelly, A.M., **S. Kumaran** and N. Stone. 2010. A potential method of desticking goldfish eggs from mats. Invited presentation. Aquaculture America, March 1-5, San Diego, CA.

Kelly, A.M. and **S. Kumaran**. 2010. Disappearing golden shiner phenomenon- is hydrogen sulfide the culprit? ISAAH6 Conference, Tampa, FL, September 6-9.

Kelly, A.M., **S. Kumaran** and N. Stone. 2010. A potential method of destocking goldfish eggs from mats. Invited presentation at Aquaculture 2010, San Diego, CA, March 1-5.

Kelly, A.M. and **S. Kumaran**. 2010. Disappearing golden shiner phenomenon- is hydrogen sulfide the culprit? Poster presentation at UAPB Aquaculture/Fisheries Field Day. October 7.

Kumar, G. and C. Engle. 2010. The effect of hybrid catfish fingerling prices on the relative profitability of hybrid *Ictalusus punctatus* female x *Ictalurus furcatus* male, NWAC-103 *Ictalurus punctatus*, and channel catfish *Ictalurus punctatus*. Aquaculture 2010, Annual Meeting of the World Aquaculture Society, San Diego, CA, March 2.

Kumar, G. and C. Engle. 2010. How cash flow and credit constraints affect stocking strategies on U.S. catfish farms. Aquaculture/Fisheries Field Day, UAPB, Pine Bluff, AR. October 7.

Lochmann, R., H. Phillips and **J. Faukner**. 2010. The effects of a dairy/yeast prebiotic on performance and bone mineralization in fathead minnow *Pimephales promelas*. Aquaculture 2010, San Diego, California, March 1-5.

Lochmann, R., T. Sink, H. Phillips and **M. Thompson**. 2010. The effects of a dairy/yeast prebiotic on golden shiners, goldfish and channel catfish – a review. Aquaculture 2010, San Diego, CA, March 1-5.

Lochmann, S.E. and **L.A. Will**. 2010. Effect of grading frequency on production of alligator gar fingerlings in tanks. Aquaculture America. San Diego, CA, March 1-5.

Lochmann, S.E. and **L.A. Will**. 2010. Effect of grading frequency on production of alligator gar fingerlings in tanks. Southern Division of the American Fisheries Society, Asheville, North Carolina, February 24-28.

Olive, J., **L.A. Will** and S.E. Lochmann. 2010. Grass carp movement and persistence in Felsenthal Reservoir, Arkansas. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Biloxi, MS, October 17-20.

Peacock, C.R., B.G. Batten and S.E. Lochmann. 2010. Relationships between largemouth bass *Micropterus salmoides* and hydrology in the Arkansas River. Oral presentation. Annual Southern Division AFS Student Colloquium. October 5-7, Mountain View, AR.

Peacock, C.R. and M.A. Eggleton. 2010. Assessment of length-limit regulations for largemouth bass fisheries in the Arkansas River. Oral paper. Arkansas-Oklahoma AFS Chapter Annual Meeting, February 3-5, Fort Smith, AR.

Phillips, H., **J. Faukner**, R. Chen and R. Lochmann. 2010. Effects of traditional and alternative diets with 28- or 32% protein on performance of golden shiners *Notemigonus crysoleucas* in pools. Aquaculture/Fisheries Field Day, UAPB, October 7.

Rabbani, A.G., M.M. Dey and K. Singh. 2010. Determinants of catfish importation in USA: an application of augmented gravity model. Aquaculture 2010. San Diego, CA, March 5.

Rabbani, A. 2010. Determinants of catfish importation in USA: An application of augmented gravity model. UAPB Twenty-third annual student/faculty research forum. Pine Bluff, AR, March 10.

Sapkota, P. 2010. Development of mixed-integer mathematical programming model for hybrid striped bass fingerling production. UAPB Twenty-third annual student/faculty research forum. Pine Bluff, AR, March 10.

Sapkota, P. and C. Engle. 2010. A comparative analysis of economic risk of hybrid striped bass fingerling production. Aquaculture/Fisheries Field Day, UAPB, Pine Bluff, AR. October 7.

Thapa, G., M.M. Dey and K. Singh. 2010. Consumer preferences for seafood in the northeastern region of USA: results of Asian ethnic fish market survey. Aquaculture 2010. San Diego, CA, March 5.

Thapa, G. Consumer preferences for seafood in the Northern Region of the USA. UAPB Twenty-third annual student/faculty research forum. Pine Bluff, AR, March 10.

Thapa, G., M. Dey and K. Singh. 2010. Live fish market in the northeastern region of the USA: implications for the catfish farmers of Arkansas. Aquaculture/Fisheries Field Day. October 7.

Will, L.A. and S.E. Lochmann. 2010. Effect of grading frequency on production of alligator gar fingerlings in tanks. Arkansas-Oklahoma Chapter Meeting of the American Fisheries Society. Fort Smith, AR, February 3-5.

2009

Adelsberger, C., J.W. Neal and S.E. Lochmann. 2009. Larval collection and observed movement of telemetered bigmouth sleeper *Gobiomorus dormitor* in Puerto Rico. Association of Research Directors, Atlanta, Georgia, March 29-31.

Adelsberger, C., J.W. Neal and S.E. Lochmann. 2009. Larval collection and observed movements of telemetered bigmouth sleeper *Gobiomorus dormitor* in Puerto Rico. Southern Division of the American Fisheries Society, New Orleans, Louisiana, January 14-18.

Adelsberger, C.J., W. Neal and S.E. Lochmann. 2009. Larval collection and observed movements of telemetered bigmouth sleeper *Gobiomorus dormitory* in Puerto Rico. Arkansas Chapter of the American Fisheries Society, Bentonville, Arkansas, February 4-6.

Adelsberger, C., J.W. Neal and S.E. Lochmann. 2009. Natural life history characteristics of bigmouth sleeper *Gobiomorus dormitor* in Puerto Rico Rivers. American Fisheries Society Annual Meeting, Nashville, Tennessee. August 30 – September 3, 2009.

Eklund, P.E., C.R. Engle and M. Oliver. 2009. Management of aquatic weeds in public waters of Arkansas: species and current control techniques. 1890 Association of Research Directors, Atlanta, Georgia.

Fontaine, B.V., C.P. Hutt and M.A. Eggleton. 2009. Assessment of catch and exploitation of largemouth bass on the lower Arkansas River. 1890 Assn. Research Director's Meeting, Atlanta, GA.

Fontaine, B.V., C.P. Hutt and M.A. Eggleton. 2009. Assessment of catch and exploitation of largemouth bass on the lower Arkansas River. Southern Division of the American Fisheries Society, New Orleans, LA.

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Horne, J. and S.E. Lochmann. 2009. An evaluation of the effects of stocking hatchery largemouth bass fingerglings on wild largemouth bass fingerlings in back waters of the Arkansas River. American Fisheries Society Annual Meeting, Nashville, Tennessee. August 30 – September 3, 2009.

Jose, M.T. and A. Haukenes. 2009. Characterization of channel catfish egg quality spawned under different environmental conditions. Aquaculture America 2009. Seattle, WA. February 15-18.

Jose, M.T. and A. Haukenes. 2009. Characterization of channel catfish egg quality spawned under different environmental conditions. ARD Biennial Research Symposium. Atlanta, GA.

Jose, M.T., R. Lochmann, T. Sink and R. Chen. 2009. The effects of a diary/yeast prebiotic and extra vitamin C on heat tolerance and disease resistance of largemouth bass fingerlings. UAPB Twenty-second annual student/faculty research forum. Pine Bluff, AR, March 11-12.

Kumar, G. and C.R. Engle. 2009. Economics and risk of food fish production from fingerlings of hybrid catfish as compared to channel catfish strains. 1890 Association of Research Directors, Atlanta, Georgia.

Nanninga, A.S. and C.R. Engle. 2009. Preventing winter weight loss of catfish. 1890 Association of Research Directors, Atlanta, Georgia.

Paver, A.N. and N. Stone. 2009. Controlling fungus during jar incubation of rosy red fathead minnow eggs. Poster. Arkansas Bait and Ornamental Fish Growers Association, Lonoke Aquaculture Workshop. February 12.

Paver, A.N. and N. Stone. 2009. Substrate preference of rosy red fathead minnow. Poster. Arkansas Bait and Ornamental Fish Growers Association, Lonoke Aquaculture Workshop. February 12.

Sudhakaran, P.O., C.R. Engle, B. Southworth and A. Nanninga. 2009. Does harvesting and grading catfish more frequently improve overall production of catfish? 1890 Association of Research Directors, Atlanta, Georgia.

Thompson, M. and R. Lochmann. 2009. The effects of soybean oil, flaxseed oil and dairy/yeast prebiotic on the growth and health of channel catfish *Ictalurus punctatus* fingerlings at low temperature. Aquaculture America 2009, Seattle, Washington, February 16-18.

Thompson, M. and R. Lochmann. 2009. The effects of soybean oil, flaxseed oil and a dairy/yeast prebiotic on the growth and health of channel catfish *Ictalurus punctatus* fingerlings at low temperature. UAPB Twenty-second annual student/faculty research forum. Pine Bluff, AR, March 11-12.

Thompson, M., T. Sink, R. Chen and R. Lochmann. 2009. The effects of soybean oil, flaxseed oil, and a dairy/yeast prebiotic on the growth and health of channel catfish *Ictalurus punctatus* fingerlings at low temperature. Poster. Rural Life Conference, UAPB, February 13.

Timmons, B. and S.E. Lochmann. 2009. Changes in sport fish characteristics and biomass of aquatic vegetation before and after biological control of vegetation in southern Arkansas. Association of Research Directors, Atlanta, Georgia, March 29-31.

Timmons, B. and S.E. Lochmann. 2009. Changes in sport fish characteristics and biomass of aquatic vegetation before and after biological control of vegetation in southern Arkansas. Arkansas Chapter of the American Fisheries Society, Bentonville, Arkansas, February 4-6.

Timmons, B.A. and S.E. Lochmann. 2009. Changes in sport fish characteristics and biomass of aquatic vegetation before and after biological control of vegetation in Southern Arkansas. American Fisheries Society Annual Meeting, Nashville, Tennessee. August 30 – September 3, 2009.

Weldon, D., R. Lochmann, R. Chen, A. Goodwin and S. Rawles. 2009. Interactive effects of vitamins C and E on the growth and health of largemouth bass *Micropterus salmoides*. Aquaculture America 2009, Seattle, Washington, February 16-18.

Weldon, D.B., R. Lochmann, R. Chen, A. Goodwin and S. Rawles. 2009. Effect of dietary vitamin C concentration on the growth and health of largemouth bass (*Microppterus salmoides*). Poster. Rural Life Conference, UAPB, February 13.

Will, L. and S.E. Lochmann. 2009. Fish assemblages on gravel bars in the Arkansas River. Arkansas Chapter of the American Fisheries Society, Bentonville, Arkansas, February 4-6.

Will, L. and S.E. Lochmann. 2009. Fish assemblages on gravel bars in the Arkansas River. Association of Research Directors, Atlanta, Georgia, March 29-31.

Will, L. and S.E. Lochmann. 2009. Fish assemblages on gravel bars in the Arkansas River. Southern Division of the American Fisheries Society, New Orleans, Louisiana, January 14-18.

Will, L.A. and S.E. Lochmann. 2009. Spatial and temporal variability of fish assemblages on gravel bars in the Arkansas River. American Fisheries Society Annual Meeting, Nashville, Tennessee. August 30 – September 3, 2009.

2008

Adelsberger, C. and J.W. Neal. 2008. Comparison of larval sampling techniques in two Puerto Rico river mouths. Joint Annual Meeting of the Arkansas and Mississippi Chapters of the American Fisheries Society. Tunica, MS, February 20-22.

Adelsberger, C. and J.W. Neal. 2008. Larval sampling in freshwater systems in Puerto Rico. Southern Division of the American Fisheries Society Mid-Year Meeting. Wheeling, WV, February 27 – March 2.

Adelsberger, C. 2008. Comparison of larval sampling techniques in two Puerto Rico river mouths. Twenty-first annual student/faculty research forum. University of Arkansas at Pine Bluff. March 12-13.

Eklund, P., C. Engle and M. Oliver. 2008. Aquatic nuisance plant species in Arkansas. Aquaculture America 2008, Annual Meeting of the U.S. Aquaculture Society, Orlando, Florida.

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Fontaine, B.V., C.P. Hutt, B.G. Batten, J.W. Neal and M.A. Eggleton. 2008. Assessment of exploitation patterns of largemouth bass *Micropterus salmoides* in the lower Arkansas River. Joint Annual Meeting of the Arkansas and Mississippi Chapters of the American Fisheries Society. Tunica, MS, February 20-22.

Fontaine, B.V., C.P. Hutt, B.G. Batten, J.W. Neal and M.A. Eggleton. 2008. Assessment of exploitation on patterns of largemouth bass in the lower Arkansas River. Arkansas and Mississippi Chapters of the American Fisheries Society, Tunica, MS.

Horne, J.R. and S.E. Lochmann. 2008. Effects of a summer high water event on young of the year largemouth bass in the Arkansas River. Southern Division of the American Fisheries Society, Wheeling, West Virginia, February 28 – March 2.

Horne, J.R. and S.E. Lochmann. 2008. Effects of a summer high water event on young of the year largemouth bass in the Arkansas River. American Fisheries Society National Meeting, Ottawa, Ontario, August.

Horne, J.R. and S.E. Lochmann. 2008. Effects of a summer high water event on young of the year largemouth bass in the Arkansas River. Mississippi – Arkansas

Chapter Meeting of the American Fisheries Society, Tunica, Mississippi, February 20-22.

Mandal, A. and C. Engle. 2008. A review of channel catfish production research at UAPB. Twenty-first annual student/faculty research forum. University of Arkansas at Pine Bluff. March 12-13.

Nanninga, A.S. and C. Engle. 2008. Winter feeding of channel catfish in multiple-batch production. Aquaculture America 2008, Annual Meeting of the U.S. Aquaculture Society, Orlando, Florida.

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Green, C.C., S.E. Lochmann and D.L. Straus. Acute toxicity of isopropyl methylphosphonic acid, a breakdown product of sarin, to early life history stages of golden shiner and channel catfish. Annual North American meeting for the Society of Environmental Toxicology and Chemistry, Austin, Texas, November 11, 2003.

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Trimpey, J. and C. Engle. 2002. Development of grading technology for catfish. Annual Research Forum 2002, UAPB.

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Fúnez, O**., I. Neira**, and C. Engle. 2001. Supermarket outlets for tilapia in Honduras: an overview of survey results. 6to. Simposio Centroamericano de la Acuacultura. Tegucigalpa, Honduras.

Hungerford, T. and J. R. Jackson. 2001. Effects of increased minimum flow and stream temperature on the growth of Centrarchids below a hydroelectric dam on the Ouachita River, Arkansas. Annual Meeting Arkansas Chapter, AFS, Heber Springs, Arkansas.

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Valderrama, D. and C. Engle. 2001. Optimización económica del cultivo del camarón en Honduras. 6to. Simposio Centroamericano de la Acuacultura. Tegucigalpa, Honduras.

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Williams, A. and J. R. Jackson. 2001. Characteristics, preferences, and motivations of first-time recreational fishing license holders in Arkansas. Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS), National Conference, Washington, D. C.

APPENDIX J
Undergraduate Student Publications, Abstracts, and Presentations

List of undergraduate abstracts published (2000-2010):

Fisher, C., S.E. Lochmann, M. Wine and S. Shoults. Propagation and rearing methods for yellowcheek darter *Etheostoma moorei*. Southern Division of the American Fisheries Society, New Orlean, Louisiana, January 14-18, 2009.

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